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Antibiotic Treatment of Western White Pine Infected With Blister Rust

Virgil D. Moss, Henry J. Viche, and William Klomparens

A MAJOR breakthrough in the control of white pine blister rust caused by the fungus, *Cronartium ribicola* Fischer, has been accomplished with the antibiotic, Acti-dione.[1] Sprayed on the basal portion of trunks, Acti-dione is absorbed and translocated upward to kill the causal fungus in blister rust infections on western white pine (*Pinus monticola* Dougl.). This timely new weapon is now being used in control areas to save western white pines that became infected with blister rust before ribes[2] were satisfactorily destroyed and also in areas where the elimination of ribes has never been attempted.

The method and progress to date of treating western white pine in the northern Rocky Mountains with the antibiotic Acti-dione BR[3] (cycloheximide) by the basal stem method are described in this paper.

THE AUTHORS are respectively research forester and forester, Blister Rust Control, Division of State and Private Forestry, Region 1, Forest Service, U. S. Dept. Agric., Missoula, Mont., and plant pathologist and head, Agricultural Research and Development, The Upjohn Co., Kalamazoo, Mich.

[1]Trademark, Reg. U. S. Pat. Off. The Upjohn brand of cycloheximide.

[2]A generic name commonly used to indicate both currant and gooseberry bushes, the intermediate host-plants of white pine blister rust.

[3]The Upjohn Company brand of a 4-percent cycloheximide concentrate used in the treatment of white pine blister rust.

Northern Rocky Mountain Conditions

Control of blister rust by destroying ribes bushes is based on the relatively short distance it spreads from ribes to pines. The effective range at which white pines are infected is generally less than 1,000 feet from ribes (*8*).

In the West, blister rust was unintentionally introduced into British Columbia in a shipment of infected white pine nursery stock from Europe in 1910 (*13*). Its presence was not discovered until 1921 in Vancouver, B. C. The first infected western white pines in northern Idaho and contiguous portions of Washington and Montana were found in 1927, although ribes infection first occurred in the region in 1923 (*8*). With optimum conditions for development of the rust, it spread quickly throughout the western white pine type.

In general blister rust control methods consist of four major coordinated activities: (1) manual destruction of ribes by chemical, mechanical, and hand grubbing methods, (2) use of silvicultural and other forest management practices to destroy ribes stored seed and seedlings, (3) antibiotic application to cure diseased trees and prevent new infections, and (4) development of rust-resistant western white pine.

Ribes control work in the Northern Rocky Mountains started in 1923 on 2,710,129 acres of western white pine that was of sufficient value to justify the cost of protection (*13*). Hand pulling and grubbing has been the principal method used to destroy ribes. Where this method was not feasible because of the associated brush or the abundance, size, location, or ribes species, the chemical and mechanical methods have been employed for ribes control (*12*).

Blister rust control is probably the most important and urgent work relating to the growth of timber in the western white pine type. Moss and Wellner (*9*) show the necessity for integrating silvicultural and other timber management practices with blister rust control to take full advantage of every natural aid that is practicable in ribes suppression. They state that basic strategy in ribes suppression is to exhaust the stored seed supply and create forest conditions unfavorable for the regeneration and growth of ribes.

Ribes control efforts are confined to units of 500 to 5,000 acres in which the maximum quantities of white pine can be produced at the least cost for blister rust control.

Mathews and Hutchison (*7*) show that 1,901,000 acres of western white pine type must be given protection from blister rust to maintain an annual cut for the next 80 years somewhere near the level of 200 to 300 million board feet, and an eventual annual cut after 80

years of 500 million board feet. The present rate of progress in ribes control will provide protection from blister rust on only about half the working unit acres required to supply these cutting quotas of western white pine. The acre-volume deficit in western white pine production is now being reappraised on the basis that the anticipated losses from blister rust infection in present growing stock will be greatly reduced with antibiotic treatment.

The antibiotic treatment is the first feasible large-scale method developed for saving western white pines infected with blister rust. Martin and Gravatt (*6*) described a manual method for saving white pines by cutting out all diseased tissue of trunk cankers and pruning infected branches. To help prevent subsequent attacks from fungi and insects, bordeaux mixture or an antiseptic paint was recommended for treating wounds of large cankers. This tree surgery technique never proved practical because of high treatment costs and the technical skill required to perform the operation.

Cycloheximide Investigations

Whiffen et al. (*16*) reported the production of the antifungal antibiotic cycloheximide by streptomycin-yielding cultures of *Streptomyces griseus* in 1946. Leach et al. (*3*) isolated it in pure crystalline form in 1947 and determined its empirical formula in 1948 (*4*). Ford et al. (*1*) recently published a literature survey covering the agricultural use of cycloheximide.

The discovery that cycloheximide had an eradicative effect on blister rust mycelium in the perimeter of excised trunk cankers on western white pine was reported in 1957 (*10*). In these tests pure crystalline cycloheximide dissolved in acetone and diluted in Sovaspray 100 isoparaffinic base oil was 83, 77, and 80 percent effective at concentrations of 150, 300, and 600 p.p.m., respectively. When the solute was diluted in No. 1 fuel oil,[4] 150 p.p.m. cycloheximide had a complete eradicative effect on blister rust mycelium in the perimeter of excised trunk cankers on western white pine (*11*).

In a trial project to train personnel and develop an efficient method of working crews, 500 pole-size western white pines were treated by the excise method on the Kaniksu National Forest in 1956. In a random sample of 100 trees, trunk infections on 97 trees were killed by cycloheximide application.

The same spray mixture was equally effective when applied to trunk cankers by the slit method. Slits 1 to 3 inches long cut by a hatchet were centered on the canker margin at the four angular summits of surface discoloration. On large cankers slits were spaced 4 inches apart. This proved to be a more practical and economical way to treat trunk cankers than cutting out dead and dying bark by the excise method.

In a study of crew production by the excise and slit methods, 20- to 40-year-old western white pines in the Kaniksu National Forest were treated at a rate of 1.4 and 1.1 man-days per acre respectively (*15, 14*).

In testing the basal stem method of application in 1957, Moss observed that cycloheximide had an eradicative effect on trunk and branch infections above the area of treatment as well as on cankers directly sprayed with the antibiotic. This observation of systemic action indicated cycloheximide was translocated upward in the trunk in quantities sufficient to eradicate the pathogen located above the site of application. The suspected systemic movement was later substantiated by direct analytical methods.

Lemin et al. (*5*) utilizing both bioassay measurements and paper chromatographic identification of cycloheximide in extracts from needle, bark, and xylem samples collected ½, 1, 2, 4, 8, 16, 32, 64, and 128 days after treatment, found that cycloheximide is absorbed by, persists in, and is translocated upward in western white pine. The tissue samples used in the experiments were collected from pole-size trees treated with 120 p.p.m. cycloheximide by the basal stem method. The upward movement of the absorbed cycloheximide was reported to be through the water-conducting elements since the antibiotic was detected in xylem both at and above the site of application but not in cortical tissue above the treated area of the trunk.

The persistence and location of the translocated cycloheximide collected from western white pine is diagrammatically illustrated in Figure 1 (*5*). Lemin et al. also reported that the lower limit for

[4] A volatile distillate oil for use in burners preparing fuel for burning solely by vaporization that is commercially marketed as stove oil in the Pacific Northwest and Northern Rocky Mountain states.

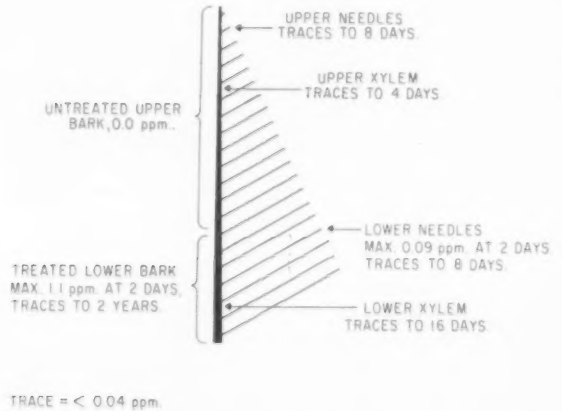

FIG. 1.—Persistence and location of absorbed and translocated cycloheximide in western white pine treated by the basal stem method.

quantitative measurement was 2.0 micrograms per cc. Any value below 2.0 micrograms per cc was therefore recorded as a trace. In samples collected from western white pine treated with 200 p.p.m. cycloheximide, trace amounts were detected in lower bark 2 years after applying cycloheximide by the basal stem method.

Continuing their study of crew production in 1958, the Kaniksu National Forest (*14*) reported that 110,334 western white pines, 20 to 40 years old, averaging 313 trees per acre, were treated by the basal stem method at a rate of 0.72 man-days per year. Larson (*2*) reported that in 1959 the Kaniksu Forest treated by the basal stem method 1,278,400 western white pine trees on 4,862 acres at a rate of 0.61 man-days per acre (Fig. 2).

Real progress has been made in antibiotic use. In 1958, a total of 294,200 trees were treated by the slit and basal stem methods in the western white pine region. In 1959, more than 4 million western white pines were treated by the basal stem method (Table 1). Also in 1959, basal stem work with Acti-dione was started on western white pine in Glacier National Park.

The effectiveness of cycloheximide solvent, concentration, diluent, additive, and method of application on western white pine infected with blister rust has been described by Moss (*11*). In 1959, the authors examined several thousand trees sprayed by forest workers in 1958 and found that more than 80 percent of the infections above and at the site of treatment were killed with cycloheximide by basal stem application. Tree inspections together with observations made in training and supervising crews in 1959 showed that most failures to completely eradicate the pathogen resulted from (1) low volume application (i.e., not visually saturating bark surface with spray), (2) applying spray on one side of a tree only, or (3) impermeable bark surface due to a pitched-over trunk canker.

Moss found that the season of treatment did not affect cycloheximide action but it did cause significant differences in the time required for cycloheximide to completely eradicate the pathogen. When trees are treated in the incipient and flush growth periods, the fungus in most blister rust infections succumbs the same season. On trees in rest and dormancy, little if any cycloheximide action is apparent until *after* the next flush growth period.

Cycloheximide effect first is observed when the yellowish-orange cortical tissue that outlines a canker margin begins to turn light brown. Progressively, the color darkens until all diseased tissue appears blackish-brown. Then as new growth develops and the bark cracks around the canker margin, the blackish-colored tissue becomes shriveled and depressed to outline the region of cortical area that was killed by blister rust mycelium (Fig. 3). The time for the diseased area to become blackened and depressed varies from a few months for small diameter trees up to about 18 months for pole-size trees. Finally, the dead bark starts to loosen as new callus tissue forming

TABLE 1.—PROGRESS OF TREATING WESTERN WHITE PINE WITH ACTI-DIONE BY THE BASAL STEM METHOD IN 1959[1]

Western white pine forest unit	Trees[2] treated	Acres worked	Man-days	Per acre: Trees treated	Per acre: Man-days
	Number	*Number*	*Number*	*Number*	*Number*
Clearwater	568,000	1,730	1,340	328	.77
Coeur d'Alene	429,000	1,300	1,250	330	.96
Kaniksu	1,283,000	4,890	3,000	262	.61
Kootenai	509,000	1,290	670	395	.52
St. Joe	1,243,000	7,440	2,870	167	.39
Glacier National Park	38,000	860	190	44	.22
Total	4,070,000	17,510	9,130	232	.52

[1]Production figures for the C.Y. 1959, Annual Report, White Pine Blister Rust Control, Division of State and Private Forestry, Region 1, U. S. Forest Service, Missoula, Mont.

[2]From 1/10-acre random sample plots.

FIG. 2.—Cycloheximide (Acti-dione BR) is applied to the lower portion of trunks and proximal ends of attached branches on western white pine with a compressed air sprayer.

around the canker margin begins to cover the exposed xylem wood of canker wounds (Fig. 4).

Basal Stem Application

Forest workers are easily trained to use the basal stem method because there is no need to identify blister rust infections or incise diseased bark of trunks to facilitate spray penetration. Instead, all potential crop trees of good color and growth are sprayed.

Antibiotic spray is applied to the lower portion of trunks and the proximal ends of attached branches. Application procedure is the same for all sizes of western white pine except for the amount of tree trunk sprayed.

Trees less than 12 feet tall, spray lower third of trunk.

Trees over 12 feet tall, spray to height of 5 feet or eye level.

The U. S. Forest Service's Region 1 field instructions for applying the basal stem method to western white pine are described:

1. Hold nozzle 12 to 18 inches from bole to spray both trunk and proximal ends of attached branches simultaneously.
2. Visually gauge the upper limit of application and start spraying downward to ground level.
3. Use a zigzag motion of the nozzle to wet bark of branches 12 to 18 inches from sprayed trunk.
4. Work from two or more sides of a tree to visually saturate all bark surface with spray.
5. Spray small trees only to trunk heights specified to avoid leader and foliage injury from oil solution.
6. Open growing trees less than 15 years of age should not be sprayed in flush growth period as oil solution may injure trunk bark.
7. In stands more than 20 years old, select dominant and codominant trees with less than $\frac{2}{3}$ of the trunk circumference girdled by blister rust.

Antibiotic solution applied to western white pine in all seasonal growth periods consists of 150 p.p.m. cycloheximide diluted in No. 1 fuel oil. Backpack compressed air sprayers are used to apply the fuel oil-antibiotic solution. Forest Service No. 100-AL[5] cast aluminum sprayer of 3-gallon capacity is one type of dispenser (Fig. 2).

Several commercial sprayers given mechanical alterations have also been made adaptable for basal stem spraying western white pine. Mounted on packboards to facilitate carrying, these compressed air sprayers include the following: Hudson Clipper No. 215, 2-gallon

[5]Designed by John F. Breakey, mechanical engineer, Methods Development and Improvement Unit, Blister Rust Control, U. S. Forest Service, Spokane, Wash., and manufactured by Miller & Poston Manufacturing Company, Spokane, Wash.

FIG. 3.—Outline of blister rust trunk canker in which fungus action has been stopped with cycloheximide (Acti-dione BR) on western white pine. Note the area of depressed necrotic tissue as new growth develops and cracks the canker margin.

FIG. 4.—Dead bark and branches removed to show healing action of trunk canker 3 years after western white pine was treated with cycloheximide (Acti-dione BR).

capacity; Hudson Climax No. 335B, 3-gallon capacity; Hudson Booster No. 291C, 4-gallon capacity; and Dobbins Seal-Lox No. 145A, 4½-gallon capacity.

The Antibiotic Control Program

The immediate and real task of blister rust control in the western white pine region is to coordinate antibiotic application and ribes destruction activities for the economical saving of diseased western white pines and preventing new blister rust infections. As an example, the use of antibiotics has already made possible some relaxation in ribes control standards. The future status of these standards will be determined by these factors: (1) age of stand and years until it reaches merchantable size; (2) status of ribes populations and eradication workings; and (3) significance of actual losses in stocking from rust damage and the increase of new blister rust infections.

Guidelines have been established for an orderly antibiotic treatment of western white pine stands in each forest unit of the region. In general, the problem is to determine those stands most apt to succumb first from blister rust infections unless treated in the near future.

Stocking and rust-damage surveys are applied to determine work priorities for stands. Schedules for stand treatment are resolved by determining (1) actual stand values and potential final volume yields with and without antibiotic treatment, (2) number of antibiotic treatments required to bring stands to merchantable size, and (3) period of time antibiotic treatment can be deferred before serious rust losses will occur.

Work priorities for antibiotic treatment vary with the acres and age classes of western white pine stands in each forest unit. The types of stands given precedence in antibiotic treatment are classified as follows:

1. Stands under 40 years old inside white pine working units. Western white pine of this age is quickly killed by blister rust infections.

2. All pole stands inside and outside white pine working units. This age class can be brought to merchantable size with 2 or 3 curative antibiotic treatments.

3. Special-use areas such as recreational, administrative, and research and demonstration sites where western white pine has aesthetic, commercial, or scientific values.

The long-term objective is to treat with antibiotics all potentially commercial stands of western white pine in the region, if and when treatment is needed to avert serious losses from blister rust infections. To accomplish this objective, antibiotic treatment has preference over ribes eradication work in all western white pine stands over 20 years of age.

The economic importance of blister rust may be gauged by the fact that over the last 5 years an average of $1½ million has been spent annually by private landowners and state and federal governments in the Northern Rockies for ribes eradication to control the disease on western white pine. This program has been generally effective in holding the pathogen in check on selected areas. Now, for the first time, foresters have an antibiotic to help combat a major tree disease.

Antibiotic control of blister rust on western white pine has been so phenomenal that danger exists in becoming overly optimistic about the possibilities of discontinuing a ribes destruction program to prevent new infections. Today, antibiotics are used only to save western white pines that are already infected with blister rust. On the other hand, it is only natural to speculate on the future of antibiotics in aerial application and in immunizing nursery-grown seedlings for outplanting. Such experiments are now under way in the western white pine region. But until these methods are fully proved and all possible deleterious side effects on plant and animal life now under study fully explored and evaluated, reverie has no place in the action programs of blister rust control today.

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An Ecological Study of the Winter Range of Elk and Mule Deer in the Rocky Mountain National Park[1]

Leslie W. Gysel

WILD ANIMALS can bring about marked changes in the landscape. Probably in most instances a person observing a wild land area at any one time or even during the period of a few years may not realize these changes are taking place.

In Rocky Mountain National Park, it was possible to determine some of the influences of wild animals on the landscape by observing a series of square, fenced exclosures that were set up in the winter range of elk (*Cervus canadensis*) and mule deer (*Odocoileus h. hemionus*) 25 years ago. This paper is a description of the changes on this winter range based on an analysis of the exclosures and surrounding areas during the summer of 1958 and on numerous range reports by National Park Service technicians. It deals primarily with differences in plant species, size, and density, factors that have a marked influence on the quality of the range and also on the beauty of the park.

Changes that influence the landscape are of special importance in Rocky Mountain National Park because of the large number of people who come to view the mountain scenery. Approximately 1,500,000 people come to the park each year. Many stop to observe or study the plants and animals of the area with the aid of excellent pamphlets and well-trained Park Service personnel.

Rocky Mountain National Park, which is located on the Front Range of the Rocky Mountains in north central Colorado, contains approximately 255,700 acres. Mountains make up most of the area; elevations vary from 7,800 to 14,251 feet. This study was made in the area east of the Continental Divide which comprises approximately two-thirds of the park.

The part of the winter range in which the exclosures are located is an area of approximately 5,000 acres in the east central part of the park. It consists of steep lower mountain slopes, hillsides, and relatively flat valley bottoms at elevations varying from 7,800 to 8,700 feet (Fig. 1).

Vegetation on most of the winter range is composed of scattered ponderosa pine with a ground cover of shrubs, forbs, and grasses. The flat valleys or "parks" have a dense grass cover with willows, birch, and alder generally along the stream banks. Drought conditions often affect the growth of plants in this area where the annual rainfall is approximately 18 inches.

History of the Area

According to Cole (*7*), game animals were apparently sparse in the mountains before the earliest trappers and traders arrived. Later, according to the records of early explorers, elk, deer, mountain sheep, bear (both grizzly and black), mountain lions, and wolves were comparatively common (*6*). Early settlers' records indicated that very few big game animals remained in the mountainous area during the winter but migrated to the more mild plains country.

Before the settlement of the plains, bison and elk were practically eliminated from that area (*7*). Many of the larger animals that remained were forced to live in the mountains. Soon the valleys and parks in the mountains were also used for raising livestock and later for the development of recreation centers. In addition, by the early 1900's market hunters and settlers exterminated the elk and greatly reduced the number of mule deer and bighorn sheep. Because of their depredations on livestock, the grizzly bear and wolf were exterminated and the black bear and mountain lion greatly reduced.

In 1913, this trend began to change. Twenty-five elk were liberated in the vicinity of the park during that year and in 1915, 25 more were released. Rocky Mountain National Park was established in 1915.

As the elk and deer populations increased, they were confined to a limited area and were forced to adapt themselves to mountain conditions both summer and winter because of the construction of a large number of homes and extensive recreation and reclamation developments.

By 1931, Park Service personnel

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saw the need for additional winter range within the park boundaries and as a result Horseshoe Park and areas along Beaver Creek, Buck Creek, and Mill Creek were purchased and incorporated into the park. These are the areas included in this study. For some years they had been supporting from 100 to 225 elk and 600 to 1,000 deer plus many cattle and horses. In addition, a good share of the meadow type in these areas had been fenced and had been yielding hay crops for at least 15 years.

By the time the 1930 animal census was made in the park, there were an estimated 330 elk and 2,500 mule deer. In 1944, the count was 1,000 elk and 1,400 mule deer.

When it was decided that overpopulation of the winter range in the park was becoming a serious problem, the National Park in cooperation with the Colorado Game and Fish Department attempted to reduce animal numbers by hunter control outside the park. When this did not work, a direct reduction was carried on in the park by Park Service personnel. During the period 1944 to 1953, 1,045 elk and 318 deer were removed from the range. The present populations are approximately 500 elk and 700 mule deer on the east side of the Divide (Fig. 2).

Park policy permits reduction of numbers of a wildlife species when populations are greater than the food supply can support. Whenever possible, however, all forms of wildlife, predator and prey, are left unmolested. The dominant theme of management is that the whole natural community shall be subject to a minimum of human interference or manipulation and that there shall be a free play of natural processes.

Methods

Twelve exclosures, established in 1933 and 1934, and the surrounding areas were used for most of the measurements and observations. The exclosures, which are 20 feet square, are made of wire fence 6 feet in height. There was no observation or indication that deer went over this fence. A few additional observations and measurements were also made in a 100-foot square exclosure which was established in 1948.

The line interception method was used in the exclosures and in the adjacent check areas to determine the present plant species, composition, and density. In each 20-foot exclosure, measurements were made along four lines, 16 feet in length spaced 4 feet apart; this left an unmeasured margin of 2 feet inside the fence at the ends of each line with a 4-foot margin parallel with the two outside lines. Measurements were also made along four lines 16 feet in length outside the exclosures. These lines were extensions of intercept lines established inside the exclosure; two alternate lines were measured from opposite sides of each exclosure commencing 4 feet from the fence. Areas sampled by these measurements are referred to as check plots.

The measurements of the intercepts of vegetation were made according to methods described by Canfield (*1*). Grasses, grass-like plants, rosette forming plants, and weeds were measured at the ground surface; shrubs were measured on the crown spread intercept. The height of each plant intercepted by the line was also recorded. Comparisons were based on the totals of the intercept measurements for each species in the exclosures and check plots.

The diameter and height of all trees both inside the exclosures and in the check plots were determined. Increment borings were taken to determine the age of the various size classes.

Detailed notes for each exclosure, adjacent check plots, and the surrounding areas included the effect of browsing on plant species, evidence of plant mortality, and the effects of the activity of rodents and rabbits. Also noted were various site factors such as elevation, slope, aspect, soil depth and tex-

FIG. 1.—Openings in the forest in the central Rocky Mountains are called "parks." Beaver Meadow, the tree-studded "park" in the center, and Moraine Park beyond are important food producing meadows for wildlife.

FIG. 2.—A bull elk and his harem in Beaver Meadow on September 29.

(Photo by Joseph S. Dixon, Field Naturalist, Rocky Mountain National Park)

ture.

To determine the relative intensity of animal use at the present time, pellet counts were made in 75 milacre quadrats mechanically spaced along lines in the general area of each of the exclosures.

An important phase of this study was the analysis of the annual wildlife reports for the period 1931-1936, the special reports concerning problems and management of the winter range, and the animal census reports which are in the files of the Rocky Mountain National Park. All of these provided excellent data for interpreting and describing the ecological changes that have taken place.

Results

The exclosures protected plants inside the fence from elk and deer. Other environmental factors affecting the growth of plants were apparently similar inside and outside the exclosures. I have therefore assumed that the major differences between fenced and unfenced plots in species composition and amount of cover are due to the browsing, trampling, and grazing outside the exclosures. The shrub species and amount of cover at the time the exclosures were set up was determined from original diagrams.

Reference is made to various exclosures by place names. Horseshoe Park is the northernmost of the wintering areas considered in this study. It consists of about 800 acres along Fall River. Beaver Meadow is about a mile south of Horseshoe Park and is nearly the same size. The exclosures on Deer Mountain and Eagle Cliffs are on the uplands above a valley that is an eastern extension of lower Beaver Meadow. Tuxedo Park and Mill Creek are about a mile and a half south of Beaver Meadow on the slope north of Mill Creek. An additional reference that will serve to orient the whole study area—Beaver Meadow is four miles due west from Estes Park.

The effects of the animals on the winter range are discussed by plant species or plant groups. Species that are important on the landscape and are markedly affected by animals are discussed individually. Others are considered by natural plant groups. Plot names are according to Harrington (*10*).

Descriptions of the aesthetic qualities of plants or plant groups are based on personal opinions of the author.

Ponderosa Pine

On most of the slopes in the winter range, except the north-facing, ponderosa pine (*Pinus ponderosa*) is the most common tree. The trees are often widely scattered or sometimes occur in small closed groups.

Ponderosa pine occurred in only two of the exclosures, in lower Beaver Meadow and Tuxedo Park. The pine in Beaver Meadow was a seedling when the exclosure was erected; the two in Tuxedo Park seeded in 4 years after the exclosure was built. In both exclosures the protected pines were 15 to 20 feet tall, approximately three times the height of unprotected pines of similar age.

Many young scattered pines without protection were mangled by a combination of browsing and scraping by antlers. Side branches and leaders were clipped off or broken and the main stems were often heavily scarred. Some of the trees died but others continued to hang on. One that was measured was 2.5 inches in diameter at the base, 8 feet in height, and 19 years old. Another that was just getting above the heavy browsing after years of struggle was 2 inches d.b.h., 10 feet in height, and 34 years old. Trees damaged to this extent were most common throughout the uplands bordering Beaver Meadow where most of the young trees were growing.

I noted that seedlings and saplings were missing entirely in the other exclosures and surrounding areas although there were sufficient seed trees. This is probably due in part to the lack of a fortuitous combination of a heavy seed crop followed by an above average rainfall during the growing season, a

FIG. 3.—Old scars on aspen that resulted from elk eating the bark. Two trees are dying and one is dead.

FIG. 4.—When this exclosure was set up, aspen saplings were numerous on this hillside. Elk and deer have eliminated all except those in the exclosure (Horseshoe Park).

combination which is necessary for the germination and establishment of seedlings (*8*). When seedlings do become established, many of the small rodents and rabbits that occur in the winter range probably feed on them, although this was not observed because there were so few seedlings.

It is no wonder that the existing ponderosa pine stands continue to remain open. It was interesting to note while comparing the photographs of the exclosure areas taken 23 years ago with present conditions that openings in the surrounding stands changed only slightly.

Ponderosa pine is a beautiful tree in the open or in stands. Additional pine on the south slopes of the winter range might be desirable aesthetically; however, it is common in other areas in the park. Probably the most important result of an increase in pine would be a reduction in the amount of winter range foods—shrubs, herbs, and grasses.

Trembling Aspen

The plight of aspen (*Populus tremuloides*) in the winter range has been the object of many discussions by park naturalists. Dixon (*9*) first noted, in the winter of 1929, that elk began to eat the bark of aspen trees. Since then most of the small stands in the winter range area have been heavily scarred by elk.

These scars are all sizes and shapes, generally 1 to 8 inches in length and 1 to 2 inches wide. They occur from about 6 inches above the ground to 7 feet on saplings, poles, and small timber sizes. Some of the recent scars went part way into the inner bark and others went all the way to the sapwood. The wounded area becomes dark brown or black in color (Fig. 3).

It seems logical to conclude that the heavy scarring of aspen stems would weaken the trees and make them susceptible to diseases. Dixon (*9*) came to this conclusion and Packard (*13*) stated that the scars open the way for the white trunk rot (*Fomes igniarius*), willow dieback (*Cytospora chrysosperma*), and a canker. Many of the scarred trees have died or are dying; however, in some instances disease may be a secondary cause. Trees may be weakened as the result of fluctuating water tables, competition, or maturity, which may be early on poor dry sites as pointed out by Mielke (*11*). Some thrifty stands on good sites have withstood the effects of scarring and are now growing well.

Equally important in the development of aspen stands is the browsing of the small aspen root suckers. In some areas where there is little browsing, these root suckers are numerous in the vicinity of both live and dead trees, enough to perpetuate the stands. In many of the dying stands, however, root suckers have been almost completely eliminated by the continual browsing of elk and mule deer.

Two exclosures were set up in sapling aspen stands in 1933, one in Beaver Meadow and one in Horseshoe Park. Both show the results of stem scarring and the browsing of root suckers. Data from Beaver Meadow are summarized in Table 1.

All of the trees in the check plot were heavily scarred.

In Horseshoe Park the aspen in the exclosure stands out like an oasis surrounded by herbs and grasses (Fig. 4). This stand originated from suckers after beaver had clearcut the area. As the result of protection for 25 years, 31 aspen stems were growing in the exclosure. There were none outside in the check plot.

Even after the big reduction in the elk and mule deer populations, aspen suckers in many parts of the winter range have had a difficult time getting above two feet in height. In a 100-foot square exclosure set up in 1948 in a winter elk concentration area between Beaver Meadow and Moraine Park, there were many 8- to 10-foot aspen stems, a height class entirely missing outside due to browsing.

Other aspen stands which occurred in the background of photographs of the plots taken in 1935 have greatly decreased in size or disappeared entirely.

TABLE 1.—NUMBER OF DEAD AND LIVE STEMS IN THE ASPEN EXCLOSURE AND CHECK PLOT IN BEAVER MEADOW

D.b.h.	Exclosure		Check plot	
	Live	Dead	Live	Dead
Inches				
Less than 1	28	10	0	7
1	1	8	0	21
2	1	11	0	11
3	4	3	0	14
4	6	1	6	2

In the winter range area, aspen is a picturesque species. Individual trees have a distinctive beauty because of their shape and the color of the bark and leaves. The small aspen stands are a vital part of the beauty of the landscape, especially in an area dominated by conifers. Therefore each time an aspen stand is heavily scarred and browsed or disappears from the landscape, there is a change in the aesthetic values of the landscape.

Willow

Most visitors in the park who pass by Horseshoe Park and Beaver Meadow would never realize that these extensive grass areas with a few willows (*Salix* spp.) have undergone major changes. Old residents reported that a large part of these areas were once occupied by willows (*2*). High water tables probably due to beaver dams were apparently favorable for vigorous willow growth (*7*). These were cut and land drained by the early ranchers to grow hay. The park naturalist assumed that after these operations were stopped, when the areas were incorporated into the park, the spread of the willow would be slow (*2*). It has been slow, probably due in part to the effects of water table fluctuations, competition with the dense grass cover, and browsing by elk and mule deer.

At the time the exclosures were established, the willow growth was vigorous according to a description by Dixon (*9*). It was noted in subsequent wildlife reports (1934, 1935) that willow was heavily browsed by elk (*1*). In 1939, Dixon

TABLE 2.—PLANT COVER IN THE FLAT MEADOW AREAS IN BEAVER MEADOW AND HORSESHOE PARK

	Beaver Meadow		Horseshoe Park	
	Exclosure	Check	Exclosure	Check
	Percent of cover			
Grasses and sedges				
Agropyron inerme	—	—	—	1.9
Agropyron subsecundum	—	—	0.3	3.9
Bromus ciliatus	—	—	0.8	0.5
Bromus inermis	—	0.5	—	—
Calamagrostis canadensis	17.2	75.0	—	—
Koeleria cristata	—	—	—	6.0
Phleum pratense	—	—	—	0.1
Poa interior	—	—	1.6	5.5
Poa palustris	—	2.0	—	—
Carex spp.	—	0.8	—	—
Forbs				
Achillea lanulosa	—	—	—	0.5
Antennaria microphylla	—	—	—	1.6
Artemesia frigida	—	—	—	0.5
Artemesia ludoviciana	—	—	1.6	0.4
Cirsium drummondii acaulescens	—	—	0.3	8.9
Galium boreale	—	—	—	1.6
Geranium fremontii	—	1.1	—	—
Heracleum lenatum	9.4	—	—	—
Mertensia ciliata	1.9	—	—	—
Orthocarpus luteus	—	—	—	0.6
Potentilla pulcherrima	—	—	1.9	1.4
Sisymbrium altissimum	—	—	—	0.1
Solidago canadensis	—	0.8	—	—
Thalictrum fendleri	—	—	10.1	—
Shrubs and trees				
Potentilla fruticosa	—	—	35.2	9.4
Ribes cereum	21.9	—	—	—
Salix pseudocordata	70.6	—	—	—
Salix subcoerulea	—	—	45.3	—

TABLE 3.—PLANT COVER IN THE MILL CREEK AND DEER MOUNTAIN AREAS

	Mill Creek		Deer Mountain	
	Exclosure	Check	Exclosure	Check
	Percent of cover			
Grasses				
Agropyron griffithsii	—	0.8	—	—
Agropyron inerme	0.3	2.0	0.3	0.1
Bouteloua gracilis	—	0.2	—	11.6
Bromus tectorum	—	0.8	—	—
Festuca ovina	0.3	0.2	—	—
Koeleria cristata	—	0.9	—	1.1
Muhlenbergia montana	—	0.8	—	3.3
Sitanion hystrix	0.1	0.2	—	0.2
Forbs				
Artemesia carruthii	—	0.6	—	—
Artemesia frigida	—	0.8	—	1.3
Artemesia pacifica	—	—	—	1.2
Astragalus flexuosus	0.1	0.8	—	0.1
Chrysopsis villosa	—	—	—	0.5
Erigonium umbellatum	1.2	—	—	2.2
Helianthus pumilus	0.9	4.7	—	3.3
Phacelia heterophylla	—	—	—	0.4
Shrubs				
Artemesia tridentata	39.2	1.1	44.8	—
Chrysothamnus viscidiflorus	1.6	13.3	0.8	4.4
Opuntia polyeantha	—	0.4	—	—
Purshia tridentata	—	3.3	14.4	10.9
Ribes cereum	5.1	—	6.2	—
Rosa spp.	—	—	0.8	2.2

(*9*) reported that the destruction of willow in the winter had been most marked, especially in Beaver Meadow where 285 elk were counted at one time. Elk have continued to graze and browse in the flat meadows.

Three exclosures were checked in the flat meadows, two in Beaver Meadow and one in Horseshoe Park. In one in Beaver Meadow, willow (*Salix pseudocordata*) covers 70 percent of the area (Table 2) and in another 15 percent (*Salix caudata* and *Salix irrorata*). There was no willow in the check plots. In Horseshoe Park, willow (*Salix subcoerulea*) in the exclosure covered 45 percent of the area; none occurred in the check plot (Table 2 and Fig. 5). With protection, willow clumps in the exclosure grew in height (6 to 10 feet) and diameter, and were well-shaped plants with few dead stems.

The exclosures were set up at the border of bands or clumps of existing willow and the pure grass stands of the meadow. In other similar ecological situations there were some willows in the open unprotected range but all were browsed and many only 2 to 4 feet in height with numerous dead or broken stems. Without protection from elk, the willow are apparently going out in the grass-willow transition zones.

Most of the willows are now growing in a small band along the stream banks. A large proportion of these are tall vigorous plants 10 to 12 feet in height with a majority of their crowns above the browse line. Apparently these were not cut during the early haying operations. It appears that they will remain for many more years along with the thin leaf alder (*Alnus tenuifolia*) and water brich (*Betula occidentalis*).

A reduction in the amount of willow beyond the stream borders will probably not make a marked change on the landscape. More important will be the loss of browse and protection for elk afforded by the willow clumps and the loss of food for beaver.

Big Sagebrush

Big sagebrush (*Artemisia tridentata*) occurs on slopes in the winter range area; however, the distribution is spotty. After a study of the exclosures and surrounding areas, it became evident that its former distribution was probably much greater because it was possible to find many stems of plants that had died years ago. At the time these exclosures were set up, however, sagebrush made up only a small part of the cover, 3 percent in one exclosure and 1 percent in another. On two south-facing slopes, one near Mill Creek and one on the side of Deer Mountain, big sagebrush was found to cover about 40 percent of the area in the exclosures (Table 3). Outside the exclosures there were a few scattered live sagebrush plants in very poor condition from continual browsing. Without the exclosures, it would be difficult to realize the marked effects of grazing (Fig. 6).

According to animal census data and recent pellet counts, both areas were well used by approximately equal numbers of elk and deer. From all evidence available, the differences in vegetation in the exclosures and the contiguous outside areas are due to the browsing and trampling of these animals. Much of the browsing on the sagebrush was probably done by mule deer. Elk eat sagebrush (*12*), but according to a study of elk foods in the park (*5*), it makes up a small fraction of the diet.

In areas used primarily by elk in Rocky Mountain National Park, sagebrush can grow well without protection. An example of this is provided by an exclosure in Beaver Meadow where sagebrush covered 17 percent of the area 25 years ago. At the time of study, sagebrush covered approximately 40 percent of the area inside and outside of the exclosure. From an analysis of this same area, Buttery (*3*) also concluded that big sagebrush was not important in the winter diet of elk.

To me, big sagebrush has a special beauty because of the gray-green color of the small leaves; the size and shape of the individual plants are also a contrast to the smaller grasses and herbs. In the areas where it is now entirely replaced by other species there is not only a loss of good quality browse, but also the loss of an outstanding representative of the western landscape.

Antelope Brush

Antelope brush (*Purshia tridentata*) is a common shrub in the area. It grows on open slopes and in the open stands of ponderosa pine. Over many acres of the winter range area, 30 to 50 percent of the plants were dead. These were girdled at the ground line or just below by mice. There were fine teeth marks on the girdled wood and often many small holes that rodents could use existed around the base of the plants. Spencer (*14*) reported that microtine rodents were abundant from Colorado to the Pacific Coast during the winter of 1957-1958; he also mentioned that there were large numbers in central Colorado during the winter of 1956-1957.

In the exclosure areas where antelope brush made up 40 percent of the ground cover, 90 percent of the plants were dead; only about 30 percent were dead outside. This high mortality was probably a result of the protection of the plants and mice by the exclosures. The tall vigorous unbrowsed plants could have provided more complete protection and possibly more succulent bark than the smaller more open plants on the outside, and therefore there were probably more mice to make a more complete job of girdling.

In the four exclosures where antelope brush covered 3 to 6 percent of the area 25 years ago, the amount of cover had increased to 40 percent in two of them, and 18 percent in the other two before the damage by the mice. Without the protec-

FIG. 5.—The only willow left here is in the exclosure. In 1933 there were numerous small willow clumps inside and outside the exclosure (Horseshoe Park).

FIG. 6.—Most of the cover inside the exclosure is big sagebrush. Outside the cover is made up of grasses, forbs, and rabbitbrush. Dead plant remains indicate that this hillside was formerly covered with big sagebrush (Mill Creek).

tion, the cover in three of the areas was about half that in the exclosures; one was the same. Plants outside the exclosures showed signs of heavy browsing. In all of these areas deer were common and it is probable that most of the browsing was done by them.

Antelope brush is not a plant that would be noticed because of special characteristics; however, it does provide a contrast in size and color with the lower grasses and herbs. The sturdy root system and dense cover of branches and leaves help to stabilize the soil on the steep slopes. Of great importance also is the amount of good quality browse it provides to both deer and elk.

Rabbitbrush

Rabbitbrush (*Chrysothamnus viscidiflorus*) is a common plant in the area although distribution is irregular. It occurred in three exclosure areas, Bighorn Mountain, Deer Mountain, and Mill Creek where the range has been heavily used by both deer and elk. In all three areas, it covered 1 to 2 percent of the exclosures in 1933. After 25 years, the amount of cover in the exclosures remained approximately the same while outside it had increased to 4 percent in one area, 13 percent in the second, and 20 percent in the third. Rabbitbrush and antelope brush are the only species of shrubs that became more prominent on the landscape outside the exclosures.

It is browsed and early range reports indicated heavy use; however, the palatability is generally less than other browse in the park. Most plants outside the exclosure were vigorous and well-formed. The question that arises is why it did not also increase in the exclosures. Apparently this was a case of unsuccessful competition. In two of the exclosures big sagebrush had become the dominant cover and in the other choke cherry (*Prunus virginiana*) and wax currant (*Ribes cereum*) had taken most of the space.

On these heavily browsed south slopes, rabbitbrush had replaced or was replacing the more palatable browse species. Where larger shrubs were sparse, the gray-brown stems, narrow leaves, and dense clusters of yellow flowers of rabbitbrush provided a colorful addition to the landscape.

Wax Currant

Wax currant (*Ribes cereum*) is the most widely distributed of the large shrubs in the winter range. It has been a part of the landscape for a long time although not a dominant part of the cover. In 1933, it covered approximately 5 percent of the areas in which it now occurs. As a result of 25 years of protection, in five of the upland exclosures it still makes up 5 percent of the ground cover; outside, however, a decrease was indicated by a cover of 2 to 3 percent in three check plots and no plants in the other two.

Again the difference is apparently due to browsing by elk and deer. All plants outside showed evidence of continuous browsing, and were generally 2 to 3 feet in height. Currants inside the exclosures were frequently 4 to 6 feet in height.

Plants of this species provide browse and fruit for birds on both well-drained and poorly drained sites. In both situations the small lobed leaves and the red currants make an attractive plant during the summer and fall.

Grasses and Forbs

In all of the exclosures, grasses have decreased in amount of cover with the increasing cover of shrubs and trees. Outside the exclosures various species of grasses are the most common type of vegetation over the winter range area and are found everywhere except under dense tree stands. In the upland check areas, the grass cover, according to intercept measurements, varied from 5 to 33 percent and averaged about 15 percent. In the wet meadow check plots in Beaver Meadow, bluejoint reedgrass (*Calamagrostis canadensis*) made an almost complete cover.

The large concentrations of the elk on the winter range consume much grass. According to an early study on elk food requirements in Rocky Mountain National Park by Carhart (*5*), 65 percent of the diet during the winter was grass; more recent studies indicate an even greater use of grass. The most common species on the uplands, the gramma grass (*Bouteloua gracilis*), wheat grasses (*Agropyron* spp.), June grass (*Koeleria cristata*), and muhly grass (*Muhlenbergia montana*) are all utilized by elk. These are also the common genera listed in the report on winter range in 1932. The density and vigor of the grasses has increased since that time. After the cattle were removed, it was noted in the wildlife reports from 1933 to 1936 that the grasses continued to show improvement. Buttery (*3*) also concluded from his studies on the winter range in the park that since the deer-elk reduction program, better range conditions were gradually developing.

The forb group has the greatest variety of species, but they make up a small percent of the total cover, generally less than the grasses. In eight of the areas the amount of forb cover was similar in and out of the exclosure. In three, the forb cover was less inside, apparently because of competition with big sagebrush or antelope brush which covered a large part of the exclosures.

None of the forb species thrived especially well as a result of protection in the exclosures. There were more species of forbs in the unprotected check plots where trampling disturbed the soil and grazing and browsing removed the plant competition. On Deer Mountain, Mill Creek, and parts of Beaver Meadow which had been heavily grazed and trampled, forbs were common. Both elk and mule deer utilize forbs. Carhart (*5*) estimated that they make up 12 percent of the winter diet of elk.

Many of the forbs add variety to the landscape because of the color of the leaves or flowers. The sulphur flower (*Eriogonium umbellatum*) is a beautiful small plant and large groups of dwarf sunflower (*Helianthus pumilus*) or golden pea (*Thermopsis divari-*

carpa) often add beauty to a hillside or upland flat.

Summary and Conclusions

This study of the winter range of elk and mule deer is based on an analysis of plant growth in 12 exclosures and the surrounding areas made in 1958. These exclosures were erected 25 years previously and since that time numerous observations have been made in them and in adjacent areas by park technicians. These observations provided a basis for the interpretation of the data and observations made during this study.

The amount of cover of shrubs or trees was much greater inside 10 of the exclosures than on the outside; it was approximately the same inside and outside the other two exclosures. Differences on some of the areas were almost unbelievable because the species dominant in the exclosures were sparse or completely missing outside. Rabbitbrush and antelope brush were the only shrubs that increased on the open range.

The amount of grasses and forbs decreased in the exclosures. Outside on the open range, however, grasses were the most common plants. The forbs comprised a smaller amount of cover except in two heavily grazed areas.

Both deer and elk browse on shrubs and trees; however, most of the differences resulting from the protection of the exclosures are probably due to mule deer because their diet on the winter range is chiefly shrubs and trees; elk in the park exist primarily on grasses and some forbs during the winter.

It follows that deer and elk, by their browsing on the winter range, helped to maintain or increase the amount of grasses and forbs—the winter staples of the elk. Apparently the number of deer that are now in the park will be an important factor in maintaining conditions favorable for the present grass-forb cover.

If we consider the effect of browsing and grazing on the beauty of the landscape, personal opinions may differ. To some, the trend toward open grassland on the slopes may be undesirable. The open stands of ponderosa pine with a variety of understory shrubs may be more pleasing aesthetically. On the other hand, others may consider the grasslands a welcome contrast to the conifers which are dominant in other parts of the park. Most people, however, would consider the deterioration of the aspen stands an undesirable trend; the beauty of the trees and the variety they provide on the landscape of the winter range area are associations most people remember.

These changes are normal and natural results of high concentrations of elk and deer in a limited winter range. In the park it is desirable to have enough deer and elk so that visitors may have a good chance to see them. If this is done by maintaining animal populations of the present size, apparently many of the ecological trends which have been described will continue to be a part of the dynamic processes affecting the landscape.

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Coming Events

Central States Forest Tree Improvement Conference

The second Central States Forest Tree Improvement Conference will be held at the Sunset Arms Hotel, Franklin Park, Ill., October 12-13, 1960. Field trips are planned on October 13 to the Morton Arboretum and Argonne National Laboratory.

Central States Section

The meeting of the Central States Section will be held at Franklin Park, Ill., October 13-14, 1960. The theme is Recreation.

American Forestry Association

The 85th annual meeting of The American Forestry Association will be held October 16-19, 1960, with headquarters at the Edgewater Gulf Hotel, Edgewater Park, Miss.

Canadian Institute of Forestry

The 1960 annual meeting of the Canadian Institute of Forestry will be held at the Chateau Frontenac, Quebec City, Canada, October 24-27, 1960.

Soil-Site Relations of Old-Field Slash Pine Plantations in Carolina Sandhills[1]

Clark Row

THIS PAPER provides a means for predicting the height growth of slash pine plantations on old-field sites in the Sandhills of North and South Carolina, an area now largely abandoned for agriculture. Slash pine has been planted in this area during the past 25 years and has become the preferred planting species. Survival has been generally good, and many stands have been strikingly productive. Growth has varied enough, however, to indicate that indiscriminate planting of slash on these deep sands is not warranted.

The present study was one of a series which have been made on deep sand soils in the Southeast. Although Knudsen (*4*) had studied the soil-site relations of natural slash pine stands, plantations had not been investigated until Barnes and Ralston (*1*) determined the effect of soil characteristics for planted slash pine in Florida. When extended to Georgia plantations, the Florida estimating equation proved applicable to most upland soils except shallow or imperfectly drained ones (*5*). McGee later made an independent study of slash pine plantations in the Middle Coastal Plain of Georgia (*6*). Unlike prior studies, the present investigation sampled slash pine plantings beyond the species' natural range. The South and North Carolina Sandhills include the northernmost slash pine plantations on marginal sand soils.

FIG. 1.—A 17-year-old slash pine plantation on an old-field site in the South Carolina Sandhills.

The Data

Measurements were made on 127 plots in plantations throughout the area shown in Figure 2. Nearly all plots were in stands that had been established on old fields. Plantations on cleared scrub-oak areas were sought but few were found that were old enough to be included in this study. The plots' site indices (based on height 25 years after planting) were found to range from about 40 to 80 feet. Stand ages ranged from 9 to 27 years (Table 1).

The plots, which were fundamentally designed to supply information for volume and yield tables (*3*), were mostly 8 planting spaces square, though where survival had been poor, plots were larger. A plot was not taken unless the trees were at least 9 years old, unthinned, with no evidence of crown scorch from fire, and without recognizable differences in age, height, or spacing.

Most of the plantations sampled were on Kershaw, Lakeland, and Norfolk soils. These are generally characterized by light to medium gray A_1 horizons of loose sand, zones of light gray to pale yellow loose sand to loamy sand, and one, or sometimes several, layers of subsoil distinguished by finer textures and generally darker shades—yellowish to reddish brown. The subsoils have textures ranging from loamy sand to sandy clay loam and occur 12 inches to 10 or more feet below the surface.

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[1]Based on research for a master's thesis at the School of Forestry, Duke University, under the direction of Dr. C. W. Ralston, assistant professor of Forest Soils. The study was a cooperative project of Duke University and the Southeastern Forest Expt. Sta., Forest Service, U. S. Dept. Agric.

TABLE 1.—NUMBER OF PLOTS BY AGE AND 25-YEAR SITE-INDEX CLASS

Plot age class (years)	Site-index class					Total
	40 feet	50 feet	60 feet	70 feet	80 feet	
9-12	1	1	5	11	3	21
13-17	0	2	28	23	1	54
18-22	0	9	26	14	0	49
22-27	0	1	0	2	0	3
Total	1	13	59	50	4	127

Soil profile descriptions were made at two posthole sample points on a diagonal of each plot. An effort was made to reach a layer of fine texture, for Barnes and Ralston, as well as McGee, had demonstrated correlations between site index and depth to this layer. When fine-textured soil was not encountered with the posthole digger, a bucket auger was used to determine whether such a layer existed within 10 feet of the surface. In holes where fine texture was not found, a depth of 10 feet was arbitrarily assigned for statistical analysis. Composite soil samples were taken from each horizon. Supplemental measurements of surface horizons and litter were made at three other points on each plot. Major physiographic attributes were also recorded.

In the laboratory each fine-textured subsoil sample was analyzed by the Bouyoucos hydrometer method. In profiles with no layer of fine texture within 10 feet, analyses were made of all horizons below the A_1. The largest clay content thus obtained was used in the regression analysis.

For very sandy A_1 horizons, ignition in a muffle furnace was found to furnish satisfactory determinations of organic matter. For samples with a texture heavier than sand, it was apparent that the clay content influenced the organic-matter determinations by ignition, and values from wet combustion tests were used instead. An index of total organic content was calculated by multiplying the percentage of organic matter by the thickness of the A_1 horizon.

Reliable estimates of soil effects can be obtained from variations, independent of age, in total tree height. The average height-age relationship of the plantations was expressed in a form similar to that proposed by Schumacher (*7*):

$$\text{logarithm of total height} = a + b\left(\frac{1}{\text{age}}\right)$$

The deviations of individual plot values from this average height curve were often large and represented a quantitative expression of all other factors affecting tree growth. To find whether a portion of the variations was related to soil characteristics, the basic height-age equation was modified by the addition of soil variables.

The variables in this analysis were:

$x_1 = \frac{1}{\text{age}}$, where the age was plantation age plus one year in the nursery.

x_2 = thickness of A_1 horizon.

x_3 = depth to fine-textured horizon.

x_4 = percentage of clay in fine-textured horizon.

x_5 = total organic-matter index (x_2 times percent of organic matter).

x_6 = topographic position (+1 for ridgetops and upper slopes, −1 for lower slopes and flats).

x_7 = (depth to fine texture).^{2}

x_8 = (depth to fine texture) $\frac{1}{\text{age}}$.

x_9 = (depth to fine texture)^2 $\frac{1}{\text{age}}$.

The significant variables in the regression analysis, in addition to the reciprocal of age, were: x_7, the square of depth to fine texture, and x_2, the thickness of the A_1 horizon,

FIG. 2.—Sandhills region of South and North Carolina.

both significant at the one-percent level. The equation for these variables is:

$$\log \text{height} = 1.987 - 5.941 \frac{1}{\text{age}} + 0.008963 \text{ (thickness of } A_1\text{)} - 0.000004245 \text{ (depth to fine texture)}^2.$$

The coefficient of multiple correlation (R) of this regression is .89. Individual plot error is approximately 10.5 percent. Figure 3 is a graph of the equation adjusted to show site-index at plantation age 25. When the thickness of A_1 horizon and depth to fine texture of a soil are known, the expected stand height 25 years after planting can be read directly from the graph.

Some longleaf and loblolly pine plantations also were measured, but no independent soil-site analyses were made. Predicted heights of slash pine for the soil characteristics of each of the 44 longleaf and 31 loblolly plots were compared with the actual heights of the trees. It was assumed that the planted longleaf had remained in the grass for 3 years. Longleaf heights averaged 26 percent less than those of slash pine of comparable age on similar soils. Average heights for loblolly were about 18 percent less. Figure 4 shows the height-age curves, adjusted to plantation age, for all three species. Although the comparisons are not conclusive, it appears likely that longleaf or loblolly may not make as good 25-year height growth as slash pine on most Sandhill sites.

Discussion

The two soil factors found related to height growth, thickness of the A_1 horizon, and depth to fine texture, are the same that McGee established in Georgia.

The detrimental effect of increased depth to fine texture was much less in the Carolinas than in Georgia. The explanation may largely be in sample differences. All but one of the Carolina plots on very deep sands were in old-field plantations. Most of the few plots on such soils in Georgia were in areas cleared of scrub oaks and showed the relatively slow growth previously observed on such sites in Florida (*1*), where the difference averaged about 7 feet at age 25. Because of this, an estimating equation based primarily on a sample of old-field sites must be used with caution, if at all, in evaluating scrub-oak land.

In Georgia, McGee found a decrease in site quality on a number of plots where erosion had nearly exposed the fine-textured soil. Very few plots with extremely shallow subsoils were found in the Carolinas and the effect was not significant.

The increase of site quality with thicker A_1 horizons may be caused by the beneficial effects of organic matter, as few A_1 horizon samples had appreciable clay content. Barrett found that the total organic content, as well as thickness of A_1, was related to site quality in Georgia slash pine plantations (*2*). Neither in his study nor the present one, however, could precision in estimating site index be im-

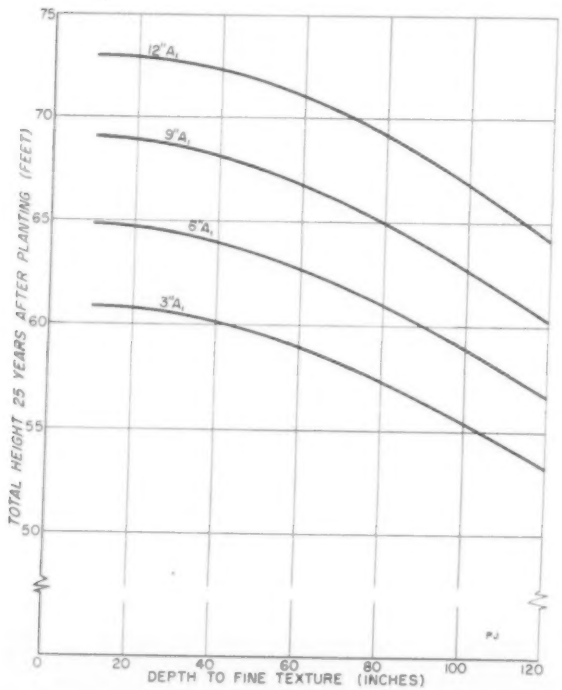

FIG. 3.—Site index for planted slash pine on old fields in the Carolina Sandhills. Tree heights at plantation age 25 are largely correlated with thickness of A_1 horizon and depth to fine-textured soil.

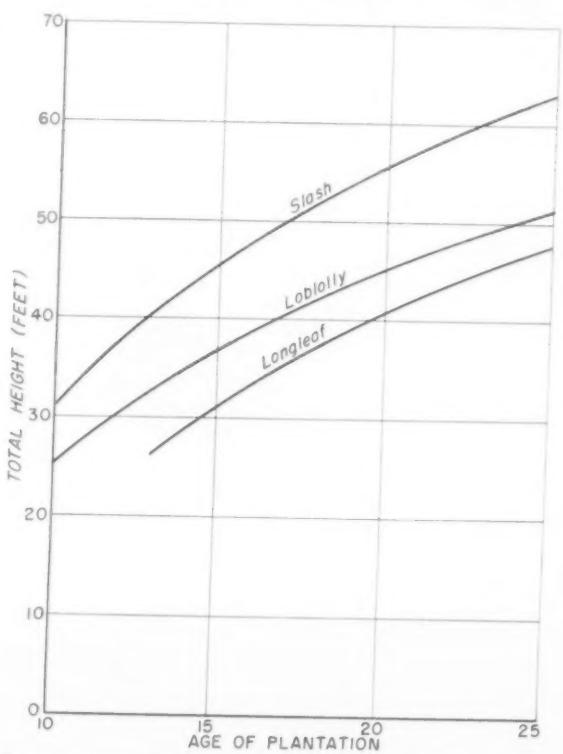

FIG. 4.—Average height-age curves for planted slash, loblolly, and longleaf pines on deep sand soils.

proved by substituting total organic matter index for the A_1 thickness or using it as an additional variable.

The reciprocal of the A_1 horizon depth in McGee's Georgia study was significant when A_1 horizons were less than 3 inches thick. In this study only three such shallow soils were found and this variable was not tested.

Factors difficult to treat statistically may have caused considerable portions of the residual error. For instance, in the summer of 1957 several of the very deep sands had water tables within the 10-foot auger depth. A number of additional plots, in which water tables were not observed in the summer of 1957, were revisited the next spring and tables were found within a few feet of the surface. Tree heights on plots with water tables were considerably greater than predicted by the analysis, but their quantitative effect could not be established from measurements taken in this study.

Tip-moth damage was observed on a few plots. Many other plantations undoubtedly had been infested while young, and—to some unknown degree—retarded in height growth. Tip-moth effects are very difficult to estimate after a few years.

In using the results, therefore, it must be remembered that the predicting equation is not applicable to scrub-oak areas. It may also be unreliable for those few sites with a depth to fine-textured layer of less than 20 inches, an A_1 horizon less than 3 inches thick, or a high water table.

Summary

Data were collected from 127 plots in slash pine plantations on old fields in the Sandhills of South and North Carolina in order to correlate height growth with soil factors.

Statistical analysis demonstrated that heights of slash plantations can be estimated from their age and two soil variables: Depth to a fine-textured horizon, and thickness of the A_1 horizon.

An estimate of 25-year site index for a prospective planting area can be made when measurements of the soil variables are inserted either into the estimating equation or into the simplified graphic solution provided in this article.

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From the Forest—

Products for Better Living

NATIONAL FOREST PRODUCTS WEEK

OCTOBER 16-22 1960

Controlling Southern Weed Trees With Herbicides

Fred A. Peevy

A LARGE percentage of the growing space on southern forest land is occupied by undesirable trees. These need to be controlled if full benefits are to be obtained from the land. Foresters have put practices such as fire exclusion in effect in recent years because of the urgent need for greater timber production. These practices are beneficial to all species. Therefore, scrub hardwoods have increased and are competing effectively with pines and other desirable species of trees and forage plants.

Methods of Control

A number of herbicides applied by several methods have been evaluated during the past 15 years at the Alexandria Research Center of the Southern Forest Experiment Station. Herbicides applied to individual trees or as a foliar spray are effective for killing woody plants. The method of control to be used depends on the size of stems, density of stand, size and location of area to be treated, and personal preference of the landowner. The purpose of this article is to discuss effective methods of controlling weed trees with herbicides.

Application in Ax Cuts

Frill method.—The application of 8 pounds of acid equivalent of an ester of 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) in 100 gallons of diesel oil kills undesirable species effectively on upland and bottom sites. Frills should be made near the ground and thoroughly saturated with the solution for good root kill. The best kills are obtained during spring and early summer. This treatment costs approximately 0.5 cent for chemical and labor for applying 21 milliliters (ml.) of material per inch of stem diameter for diameters measured at breast height (Fig. 1). A solution containing 2 pounds per gallon of ammonium sulfamate (Ammate) in water is safer than 2,4,5-T to use around sensitive crop plants.

Notch method.—Apply ½ ounce of Ammate crystals per notch for notches spaced 4 to 6 inches apart, edge to edge, near ground level around the base of trees to kill trees less than 8 inches in diameter throughout the year. The approximate cost of chemical and labor is 0.7 cent per inch of diameter. Ammate applied at this rate is also effective on stumps. Ammate is being applied less extensively by these two methods since less laborious methods have been developed. Some information on relative costs is presented in Table 1.

Basal Stem Spray

Trees under 8 inches in diameter are killed by basal stem applications at all seasons of the year. Apply 48 ml. per inch of diameter of a solution containing 8 pounds of acid equivalent of 2,4,5-T ester per hundred gallons of diesel oil to the lower 8-12 inches of the tree trunk. The base of the stem should be sprayed until the solution runs down the trunk to the root collar. This same treatment is effective on stumps of felled trees, providing the entire stump is wet with the solution. The cost is approximately 0.6 cent per inch of tree diameter for chemical and labor (Fig. 2).

FIG. 1.—Applying herbicidal solution in frill.

Tree Injection

Several tools have been tested for injecting herbicides into woody plants. The Cornell tool was among the first tested, but it has some objectionable features, such as a brittle cutting point, limited liquid-holding capacity, and an inadequate dosage regulator. In recent years, other injectors that hold about a gallon of solution, have good cutting points, and have a hand valve for controlling dosage have been developed. After jabbing the bit of one of the improved injectors through the bark and into the sap wood, the amount of herbicidal solution to be injected is controlled by a hand valve. A herbicidal solution that is effective for hardwood control can be made by mixing one gallon of 2,4,5-T ester containing 4 pounds of acid equivalent with 19 gallons of diesel oil. This solution should be applied at a rate of not less than 8 ml. per inch of tree diameter. Injections should be made 2 inches apart, edge to edge, around the base of the trunk of species such as post oak, blackjack oak, and red oak and near ground level. Injections should be made 1 inch apart around the base of sweetgum (*Liquidambar styraciflua*), blackgum (*Nyssa sylvatica*), hickory (*Carya*

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TABLE 1.—APPROXIMATE COSTS OF VARIOUS HERBICIDAL TREATMENTS USED FOR WOODY-PLANT CONTROL

Types of application	Chemical	Concentration	Dose per inch of diameter	Chemical and labor costs[1]
				Cents
Tree injection	2,4,5-T ester	4 lb. of 2,4,5-T in 19 gal. of diesel oil	8 ml. (1.5 tsp)	.3/inch d.b.h.
Soil injection	Fenuron	16 lb. per 100 gal. of water	60 ml. (4 tbsp)	.8/inch d.b.h.
Stem frills	2,4,5-T ester	8 lb. of 2,4,5-T in 98 gal. of diesel oil	21 ml. (1½ tbsp)[2]	.5/inch d.b.h.
Stem frills	Ammate	2 lb. per gal. of water	21 ml. (1½ tbsp)	.5/inch d.b.h.
Stem notches (cups)	Ammate	Ammate crystals	¼ oz by weight[3] (1.5 tsp)	.7/inch d.b.h.
Basal stem spray	2,4,5-T ester	8 lb. of 2,4,5-T in 98 gal. of diesel oil	48 ml.[4] (3.2 tbsp)	.6/inch d.b.h.
Stumps	2,4,5-T ester	16 lb. of 2,4,5-T in 96 gal. of oil	48 ml.[5] (3.2 tbsp)	.6/inch d.b.h.
Stumps	Ammate	Ammate crystals	¼ oz by weight (1.5 tsp)	.7/inch d.b.h.
Foliar spray (ground)	Ammate	¾ lb. per gal. of water	100 gal. per acre	$22/acre
Foliar spray (ground)	2,4,5-T	4 lb. 2,4,5-T to 98 gal. of water and 2 gal. of oil	100 gal. per acre[6]	$12/acre
Aerial foliar spray	2,4,5-T ester	2 lb. 2,4,5-T in 3.5 gal. of water and 1.5 gal. of oil	2 lb. per acre in 5 gal. carrier	$7.50 to $9/acre

[1]Labor cost is based on $1.25 per hour and cost of chemicals based on: $8.50 per gal. for 2,4,5-T ester containing 4 lb. acid/equivalent; $24.50 per hundred pounds for Ammate; $0.147 per gallon for diesel oil; $3.00 per pound for Fenuron.

[2]Wet frills thoroughly.

[3]Apply ½ oz. (1 tablespoonful) in notches made inches apart edge to edge.

[4]Thoroughly wet lower 12 inches of tree trunk.

[5]Wet entire above-ground surface of stumps.

[6]Thoroughly wet foliage and twigs.

spp.) and other hard-to-kill species. The cost of injecting 2,4,5-T ester will range from 0.25 to 0.35 cent per inch of tree diameter for chemical and labor, the cost depending on the concentration of the herbicidal solution used, spacing of injections, and density of timber stand. Injection of herbicides is a safe and economical method for applying herbicides to individual stems (Fig. 3).

Foliar Spray

Foliar sprays are most effective soon after full leaf development in the spring and become less effective during the summer. They are not effective during fall and winter. Ground equipment for foliar sprays is commonly used for brush under 15 feet in height and growing in large clumps or in dense stands and on large areas where other methods of control are not feasible.

Various types of spray equipment can be purchased. The type to be used will depend on the job to be done. Common 3- to 5-gallon capacity pressure sprayers and portable power sprayers are useful for spraying small areas. Truck and tractor-mounted power sprayers are useful for jobs too large for small equipment (Fig. 4). Aircraft can be used for spraying trees of all sizes in areas 40 acres or larger provided there is no danger of damaging susceptible crop plants by spray drift (Fig. 5). However, some species are resistant to aerial foliar sprays and, too, the herbicides may fail to reach understory brush in sufficient quantity to be effective. Spraying should be done in accordance with state regulations.

Foliar spray with ground equipment.—Two pounds of a low-volatile ester of 2,4,5-T applied per acre in 30 to 50 gallons of carrier in a uniform coverage is effective for controlling many undesirable species, such as oaks, hickory, sweetgum, and blackgum for releasing pines more than 1 year old. No permanent damage is done to native grasses, but weeds and legumes are usually killed. For site preparation, 4 pounds per acre of acid equivalent of 2,4,5-T in 100 to 150 gallons of carrier may be required for desired control. The volume to apply will depend on the density and height of plants. There should be some overlapping of sprayed areas at the outside edge of the spray swath. Retreatment

FIG. 2.—Applying herbicidal solution basal stem spray.

FIG. 3.—Application of herbicidal solution with tree injector.

FIG. 4.—Herbicidal solution can be applied efficiently with tractor-mounted equipment.

FIG. 5.—Aerial application is a fast and economical method for spraying woody plants.

FIG. 6.—Injecting Fenuron into soil for woody plant control.

is usually necessary after a growing season to kill resistant plants and those missed at the time of initial spraying.

Although a number of other herbicides have been tested, 2,4,5-T ester is effective on a wider range of plants and in most instances kills those species killed by other herbicides. 2,4,5-T can be applied by ground equipment in a concentration of 4 pounds of acid equivalent per 98 gallons of water and 2 gallons of diesel oil for about $12 per acre. However, where there are desirable crop plants sensitive to 2,4,5-T, Ammate is safer to use, but it is more costly and is corrosive to metal.

Foliar spraying with airplanes.—Aerially applied 2,4,5-T ester is effective as a foliar spray on a wider range of species than other herbicides tested. Two pounds of 2,4,5-T per acre in 3.5 gallons of water and 1.5 gallons of diesel oil effects fair to good control of most species such as blackjack oak (*Quercus marilandica*), post oak (*Q. stellata*), sweetgum, red oak, (*Q. falcata*), blackgum, and hickory growing in the upland pine sites in the South. Only poor to fair control of species that normally grow on creek bottom sites is obtained with 2,4,5-T and other herbicides.

Aerial spraying kills trees of all stem sizes of susceptible species. Costs for applying 2 pounds of 2,4,5-T per acre in a single application vary from $7.50 to $9 per acre at current prices, the cost depending on the size of the treated area and type of equipment used. Effective control is being obtained with swath widths of 36 feet. In some instances, a retreatment with 1 pound of 2,4,5-T per acre may be needed for desirable control after one growing season.

Aerial applications are most effective during spring, soon after full leaf development. Rates of 2.5 pounds or less of 2,4,5-T per acre will not do excessive damage to pines 1 year old or older. However, first-year seedlings are usually severely damaged. Ordinarily there is no serious damage to native grasses, but many weeds and legumes are usually killed.

Soil Application

Applications of herbicides such as 3-(P-chlorophenyl)-1, 1 dimethylurea (Monuron) and 3-(phenyl)-1, 1-dimethylurea (Fenuron) into the soil at the base of trees are effective for controlling oak trees under 8 inches in diameter (Fig. 6). Injections should be made around the base of the tree to a depth of 3 to 4 inches. An injection should be made for each 2 inches of tree diameter. A solution containing 0.08 to 0.16 pound of Fenuron per gallon of water should be applied at the rate of 60 ml. per inch of tree diameter. This herbicide has proved to be better than Monuron applied in a similar manner. The cost of applying Fenuron in a concentration of 0.16 pound per gallon is approximately .80 cent per inch of stem diameter for chemical and labor. Esters of 2,4-dichlorophenoxyacetic acid (2,4-D), 2-(2,4,5-trichlorophenoxy) propionic acid (silvex), 2-(2,4,-dichlorophenoxy) propionic acid, 2-(2,4,-DP), and 2,4,5-T, have not killed trees satisfactorily when applied to soil.

Reprints of List of Forestry Theses Compiled by Oregon State College

Reprints of the list of forestry theses published in the September issue of *Forest Science* are not now available. However, the type has been held by the printer and anyone wishing to order reprints at $1 per copy should write the Society of American Foresters, Mills Building, Washington 6, D. C., advising of needs. If the demand is sufficient, reprints will be printed. If not, then those needing copies of the theses list may obtain them by purchasing individual copies of the September issue of *Forest Science* at $2 per copy.

Regeneration Following Clearcutting of Oak During A Seed Year

A. D. Gammon, V. J. Rudolph, and J. L. Arend

RED AND WHITE OAKS (*Quercus rubra L.* and *Q. alba* L.), when growing on good sites, produce high quality hardwood timber. Because of the value of high quality oak, forest managers are interested in maintaining these species on sites capable of producing quality trees. However, on the better hardwood sites, oak reproduction is usually out-numbered by lighter seeded species such as American elm (*Ulmus americana* L.), sugar and red maples (*Acer saccharum* Marsh. and *A. rubrum L.*) and white ash (*Fraxinus americana* L.), as well as by less desirable species such as sassafras (*Sassafras albidum* (Nutt.) Nees), hawthorn (*Crataegus* spp.), and witchhazel (*Hamamelis virginiana* L.) (*1, 5*).

In Europe, oak is successfully regenerated by shelterwood cuttings followed by intensive cleaning and other stand improvement practices. Silviculture is governed for the most part by cutting practices that are practical under the existing economic conditions. Since we are still cutting hardwood sawtimber which was generally produced without forestry expenditures, silvicultural outlays to encourage satisfactory restocking and improve new stands need to be kept low. Weitzman and Trimble (*6*) point out that only on the more productive sites can intensive cultural practices in second-growth oak management be economically justified.

Although heavy cutting in oak stands following a good acorn crop has generally been considered a suitable method of obtaining satisfactory oak regeneration, information on this point is still very limited, particularly on the results following clearcutting (*5*). Since seed crops in oak stands are quite variable (*2*), the timing of a cutting operation to coincide with a good seed year presents a difficulty. However, Gysel (*3*) has shown that the acorn crop may be predicted for the red oak species more than a year in advance, and several months in advance for the white oaks.

An opportunity was provided in 1950 in southern Michigan to make a study of reproduction that developed after clearcutting a 45-acre oak stand coincident with a bumper acorn crop. This paper reports on the first seven years of development of reproduction after the cutting.

Stand Description

The 45-acre tract is located in Ionia County, Michigan. Its topography is generally level, but surface drainage over most of the area is good. The soil is a loam with moderately good internal drainage in the upper part of the profile, and slow, imperfect drainage in the lower part. The soils on the area belong to the gray-brown podzolic soils of the Celina and Conover series. The site quality for oak is classed as very good (*4*).

The area is bordered on the north, east, and west by old fields, and on the south by a stand similar to that on the study area before it was cut. Before cutting, the stand consisted primarily of red and white oaks, with lesser volumes of sugar maple, yellow-poplar (*Liriodendron tulipifera* L.), American elm, white ash, black cherry (*Prunus serotina* Ehrh.), and red maple. Data on the total volume and species distribution of the stand before cutting are not available; however, a tally made on an acre near the center of the stand prior to cutting showed a gross volume of 25,000 board feet about equally divided between red and white oak.

Logging was done in the winter of 1950-1951, following a good acorn crop. The slash was heavy, and was not scattered. The stand was clearcut, and only scattered, small, poorly formed unmerchantable trees were left. Views typical of the area during and after logging are shown in Figures 1 and 2. Normal hunting use of the area has continued after logging.

Study Methods

Immediately following cutting, 46 mil-acre plots were established at 100-foot intervals along three north-south lines evenly spaced across the area. In 1952, two years after logging, all tree reproduction was mapped and tallied on each plot by species, height in inches, and whether of sprout or seedling origin. The extent of browsing injury by wildlife was also recorded.

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FIG. 1.—A view of the area during logging operations. (*Photo by U. S. Forest Service, No. 470319*).

FIG. 2.—A view of the area after logging was completed in 1950. (*Photo by U. S. Forest Service, No. 470321*).

Re-inventories were made in 1953, 1955, and 1957. New reproduction was added to the plot maps and tallies as observed at each re-inventory. The data were converted to a per acre basis, and summarized by year of examination. For analyzing the height growth of the reproduction, four height classes were set up as follows:

Small seedlings and sprouts—less than 6 inches in height;

Large seedlings and sprouts—6 inches to 3 feet in height;

Small saplings—3 to 10 feet in height;

Large saplings—over 10 feet in height.

Results

In 1952 there were nearly 19,000 stems of tree species per acre. Over 91 percent of the reproduction was of seedling origin, and only 9 percent of sprout origin (Table 1). All reproduction was less than 10 feet tall. Only sugar maple, American elm, black cherry, and the miscellaneous group were represented in the 3- to 10-foot class. Most seedlings were about 9 inches tall. Yellow-poplar, which was the most numerous, averaged only 3 inches in height (Table 2). Among the sprouts, red oak was the most abundant, and also the tallest, averaging 47 inches in height. Distribution of the stocking among the plots by species was irregular, but 93 percent of all plots were stocked with some tree species.

Browsing injury by rabbits was found on 1 percent of the red oak, 4 percent of the red maple, and 9 percent of the sugar maple. For all species, rabbit damage averaged 3 percent.

Other woody and herbaceous plants present on the area in 1952 were elderberry (*Sambucus canadensis* L.), raspberry (*Rubus occidentalis* L.), blackberry (*R. candensis L.*), dogwood, thistle (*Cirsium* spp.), goldenrod (*Solidago* spp.) and milkweed (*Asclepias* spp.).

In 1953, the sprout reproduction had decreased from 9 to 3 percent. All sugar maple and white ash of sprout origin tallied in 1952 had survived, and sugar maple had

TABLE 1.—STOCKING AND SURVIVAL OF REPRODUCTION, STEMS PER ACRE

Species	Number of stems by year of examination				Surviving stems in 1957			
	1952	1953	1955	1957	From 1952 tally	From 1953 tally	From 1955 tally	New in 1957
Sprouts								
Sugar maple	40	70	90	90	20	0	70	0
Red oak	700	220	190	110	110	0	0	0
White ash	90	90	70	0	0	0	0	0
Miscellaneous[1]	460	90	90	90	90	0	0	0
All sprouts	1,290	470	440	290	220	0	70	0
Seedlings								
Yellow-poplar	4,280	4,460	1,330	660	460	180	0	20
Sugar maple	1,670	1,590	1,580	1,340	1,070	70	180	20
Red oak	830	850	770	710	560	20	100	30
White ash	1,590	1,740	2,020	1,880	1,390	170	200	120
Red maple	1,220	1,520	2,140	760	540	100	120	0
American elm	830	480	1,050	930	730	50	150	0
Black cherry	410	480	1,120	760	290	150	320	0
Miscellaneous[2]	3,070	3,280	2,210	1,680	1,170	170	170	170
All seedlings	13,000	14,590	12,220	8,720	6,210	910	1,240	360

[1]The miscellaneous group includes beech (*Fagus grandifolia* Ehrh.), and dogwood (*Cornus florida* L.).

[2]The miscellaneous group includes black oak (*Quercus velutina* Lam.), white oak, sassafras, beech, ironwood (*Ostrya virginiana* [Mill.] K. Koch), pignut hickory (*Carya glabra* [Mill.] Sweet), bitternut hickory (*C. cordiformis* [Wangenh.] K. Koch), shagbark hickory (*C. ovata* [Mill.] K. Koch), basswood (*Tilia americana* L.), dogwood, trembling aspen (*Populus tremuloides* Michx.), bigtooth aspen (*P. grandidentata* Michx.), black walnut (*Juglans nigra* L.), hawthorn, witch-hazel, and black willow (*Salix nigra* Marsh).

TABLE 2.—AVERAGE HEIGHT OF THE REPRODUCTION, BY SPECIES AND YEAR OF EXAMINATION

Species	Average height by year of examination				Average height of surviving stems in 1957			
	1952	1953	1955	1957	From 1952 tally	From 1953 tally	From 1955 tally	From 1957 tally
	Inches				*Inches*			
Sprouts								
Sugar maple	3	39	63	117	128	....	114	....
Red oak	47	62	106	174	174	....	....	....
White ash	7	10	36	....	....	....	....	....
Miscellaneous	9	22	125	142	142	....	....	....
All sprouts	29	42	85	144	152	....	114	....
Seedlings								
Yellow-poplar	3	5	23	46	50	36	....	30
Sugar maple	8	16	28	53	57	95	15	5
Red oak	6	10	13	12	13	18	7	3
White ash	9	17	29	41	49	23	16	14
Red maple	8	11	10	19	23	13	4	....
American elm	14	12	24	32	38	18	10	....
Black cherry	12	21	21	42	100	9	6	....
Miscellaneous	16	15	39	56	67	61	19	8
All seedlings	9	12	24	41	50	35	11	11

some new sprouts. Dogwood, beech, and red oak sprouts had suffered heavy mortality; however, the red oak sprouts were still the tallest of the reproduction.

Seedling mortality was greatest in yellow-poplar and in the miscellaneous group. However, new seedlings of both species resulted in a net increase in numbers. The tallest seedlings were black cherry from the 1952 tally. Yellow-poplar seedlings increased only 2 inches in average height.

All reproduction was still less than 10 feet tall in 1953. There were more stems in the 0.5- to 3-foot height class than in the shortest height class, with the exception of yellow-poplar and the miscellaneous group. The percent of stocked plots had shown a small decrease. Shrubby ground cover, composed largely of blackberry and raspberry, had increased in density on much of the area.

Rabbit-browsing injury increased in 1953, with percentages of species browsed as follows: yellow-poplar, 3 percent; red oak, 9 percent; red maple, 15 percent; American elm, 31 percent; all species averaged 9 percent injured by browsing.

By 1955 the sprout component decreased for most species although new sugar maple sprouts tended to maintain the over-all percentage of sprout reproduction at approximately 3 percent of the total. Red oak sprouts were still the tallest of all the reproduction of the important tree species, being exceeded only by dogwood sprouts.

Among the seedlings, yellow-poplar numbers decreased rapidly, red oak showed a slight decrease, and sugar maple remained about the same. Other species showed general increases, especially red maple and black cherry. Black cherry from the 1952 tally continued as the tallest of the seedling reproduction. However, most of the black cherry, sugar maple, white ash, and the miscellaneous group were represented in the large-sapling class.

The 1955 tally showed all plots stocked with some tree species. This increase in stocking over the two previous examinations resulted largely from the increase in new red maple and black cherry seedlings. Yellow-poplar numbers decreased drastically to less than one-third the number present two years earlier. The red oak and red maple seedlings made slight height growth.

Red oak was browsed most heavily by rabbits, with 60 percent of the stems having received some injury. Only 5 percent of the yellow-poplar was browsed.

Shrub and herbaceous ground cover continued to be heavy, but its composition was changing. More tolerant species such as dogwood, ribes (*Ribes* spp.) and viburnum (*Viburnum* spp.) were increasing. Trillium (*Trillium* spp.), violets (*Viola* spp.), solomonseal (*Polygonatum* spp.), and woodland fern (*Dryopteris* spp.) were also appearing.

No new sprouts were tallied in 1957. Among the sprouts, red oak continued to be the most abundant and also the tallest (Fig. 3). However, only 22 percent of the sprouts tallied in 1952 had survived. Most of the seedling reproduction was less than 3 feet tall, but all species except red oak were represented in the large sapling class (Fig. 4). All

TABLE 3.—NUMBER OF STEMS PER ACRE BY HEIGHT CLASS IN 1957

Species	Height class—feet				
	Under 0.5	0.5 to 3	3 to 10	Over 10	Total
	Numbers of stems per acre				
Sprouts					
Sugar maple	0	0	70	20	90
Red oak	0	0	0	110	110
White ash	0	0	0	0	0
Miscellaneous	0	20	0	70	90
All sprouts	0	20	70	200	290
Seedlings					
Yellow-poplar	100	170	370	20	660
Sugar maple	180	510	530	120	1,340
Red oak	170	520	20	0	710
White ash	150	970	680	80	1,880
Red maple	100	570	70	20	760
American elm	240	430	210	50	930
Black cherry	220	350	120	70	760
Miscellaneous	270	690	390	330	1,680
All seedlings	1,430	4,210	2,390	690	8,720

plots continued to be stocked with some tree species, although the stocking for each individual species had decreased. Only 20 percent of the plots were stocked with yellow-poplar.

Two-thirds of the red oak and red maple, and one-fifth of the yellow-poplar had been severely browsed by rabbits in 1957. For all species combined, 36 percent had some browsing damage.

Summary

A study was made of reproduction following clearcutting of an excellent 45-acre oak stand in 1950 in southern Michigan. The stand composition before cutting was primarily red and white oak, with lesser volumes of sugar maple, yellow-poplar, elm, white ash, and red maple. The reproduction was examined 2, 3, 5, and 7 years after logging.

Sprouts comprised a minor portion of the reproduction at each examination—less than 9 percent in 1952, and 3 percent in 1957. With the exception of red oak and red maple, sprouts did not contribute significantly to the restocking of the stand. Red oak sprouts were the most common (110 per acre), and grew better than all of the other reproduction, averaging 174 inches tall in 1957.

Seedlings originating within 2 years after cutting formed the most important reproduction on the area. In 1952 there were 13,900 seedlings per acre, mostly less than 6 inches tall. By 1955, seedlings decreased to 12,220 with the greatest mortality occurring in yellow-poplar. A few stems were over 10 feet tall.

In 1957, there were 8,720 seedlings per acre, of which 71 percent were survivors from those tallied in 1952. Most stems were in the large-seedling class, but the small- and large-sapling classes were well represented. The numbers of red oak and sugar maple had remained relatively stable while yellow-poplar decreased very markedly at each of the last two examinations.

Sugar maple, and white ash have the greatest representation in the two sapling classes (Table 3). Yellow-poplar has developed well through the small sapling class, but is sparsely represented in the large sapling class. Red oak made a poor showing in numbers, but the sprouts grew rapidly, and are the tallest of all the reproduction. They occur in clumps however, and are poorly distributed over the area for future stand value.

Rabbit browsing damage increased from 3 percent of all the reproduction in 1952, to 36 percent in 1957. Browsing by rabbits has been severely detrimental to the height growth of red oak and red maple reproduction.

Clearcutting of this oak stand has been followed by adequate reproduction to form a fully stocked new forest stand. However, the composition of the new stand bears little resemblance to that of the previous stand. The important species forming the new stand are white ash, sugar maple, American elm, black cherry and red maple, in that order. The small number of oaks now present occur in clumps of sprout origin, and their distribution in the stand is poor. Red oak seedlings have remained relatively unchanged in height since 1953, three years after the cutting, primarily because of very severe browsing damage by rabbits.

The clearcutting method has not resulted in obtaining adequate oak reproduction in the new stand on this area. For proper oak manage-

FIG. 3.—Red oak sprout growth 7 years after cutting.

FIG. 4.—Seedling reproduction in 1957, 7 years after logging. White ash, sugar maple, and black cherry are abundant, with an occasional yellow-poplar also present.

ment, harvest cuttings must be tailored to existing stand conditions. But of equal or greater importance, intensive cultural practices such as early cleanings, must follow to bring more oak through the initial establishment period. Temporary control measures to reduce the rabbit population would be helpful in permitting the oak seedlings to continue satisfactory early height growth.

In the absence of follow-up measures, conversion of oak stands to stands of more tolerant mixed hardwoods will follow cutting even as heavy as clearcutting.

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Federal Forester Qualifications

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THE JANUARY 6, 1960 announcement of Forester Examination 218B specifies revised qualification standards for foresters employed by the federal government. Included are hiring standards designed to meet current needs of federal agencies that hire foresters.

Some Sections of the Society of American Foresters and several forestry educators have expressed concern over these new standards. They believe requirements are more lenient and thereby may weaken rather than strengthen general standing of the forestry profession. These beliefs reflect need for an explanation of the changes and more information on the complex nature of the requirements for recruiting foresters in the federal government.

Educational requirements for forester positions in the federal government have developed gradually over a period of 40 years. In early years there were not enough college trained foresters in the nation to fill responsible positions in forestry agencies. Thus education could not be applied strictly as a condition of employment. Gradually, as forestry colleges graduated more and more foresters, educational requirements were increased.

By 1930 significant numbers of professionally educated foresters were being employed by the federal government. Each year thereafter agencies placed increasing emphasis on recruitment of college trained foresters. The Civil Service Commission instituted educational standards applicable to the entering grade of P-1 or later GS-5. These standards required graduation from a recognized forestry school or the equivalent in forestry school training combined with professional experience aggregating at least 4 years. They included provisions which permitted men trained through job experience alone to enter the professional forester ranks at grades above the entering level; i.e. grades 7 and above.

In 1956 the Civil Service Commission issued the first forester standard establishing minimum educational requirements for all forester positions at all grade levels. This standard also for the first time specified positive course requirements. A minimum of 20 semester hours of course work in forestry and related fields was required.

The standard provided two options: one for general foresters; one for foresters (range management).

For eligibility on the general forester register the applicant was required to have course work in 6 forestry subjects: (1) silviculture, (2) forest management, (3) forest protection, (4) forest economics, (5) forest utilization, and (6) related subjects. A minimum of 2 hours was required in each of the 6 subjects.

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Under the second or range management part of this standard minimum requirements were 20 semester hours in forestry plus courses in range management and botany. There was no requirement that course work include specifically the six forestry subjects. Under this option the standard elementary forestry courses that did not fit any of the 6 categories counted toward the required 20 hours.

After two years of hiring under this standard it was apparent to the Departments of Agriculture and of the Interior that the specifications were inadequate. Requirements as written were confusing. Applicants and forestry school faculties could not interpret them uniformly. Even the several government agencies employing foresters made different interpretations. Inequities resulted.

Also the two-option standard materially increased the cost of examining and recruiting foresters. Every paper filed under this examination had to be checked several ways: first for eligibility under the forester option and second for applicability under the range management option. Filings that rated eligible under both options were given separate ratings under each and within two grade levels, GS-5 and 7. Hence some examination filings required 4 ratings and 4 appointment registers had to be established and maintained for the recruitment of entering foresters. Costs of administration and delays in appointment action were excessive.

In 1958 the Departments of Agriculture and of the Interior working with the Civil Service Commission initiated a standards revision project. The objective was to develop more clearly defined standards which would meet current needs of federal agencies. After intensive effort by all interested agencies a revised standard was published by the Civil Service Commission in the *Federal Register* of October 13, 1959, and placed in effect by announcement of Forester Examination 218B.

Under the new standard Civil Service examining boards have one yardstick for measuring eligibility of all applicants for professional forester positions. Forestry course requirements were increased from 20 to 24 hours. The same 6-course categories are included. To assure dispersion a maximum of 6 semester hours is allowable in any one of the 6 specializations. This means the applicant must have course work in at least 4 fields. If he has 6 semester hours in "related" he must have course work in at least 3 of the first 5 hard core forestry categories.

This is patterned closely after the SAF standard for entrance to Affiliate Membership. Applicants barely meeting the minimum standard with courses in 3 of the first 5 fields plus "related" will meet SAF standards for Affiliate Membership and may advance to Junior and Member grade, provided they are graduates of schools accredited by SAF. By this comparison the government standard is believed to be reasonably comparable to the minimum standard adopted by the professional Society.

Several forestry school faculty members are concerned because they believe the new standards could permit men to qualify without courses in silviculture and forest management. Review of more than 500 individual filings under the forestry examination show that all applicants had at least 4 or 5 semester credits in each of these two categories and nearly all applicants exceeded the 6 hours allowed in determining eligibility under the 24-hour requirement.

The federal government needs foresters with substantial college course-work in silviculture and forest management. The examination process will be controlled to assure adequate education in these two key forestry subjects. Applicants lacking courses in these categories will not rate as high as those who have completed the desired specialized forestry course-work.

The federal government will continue to need a significant number of foresters whose education is predominantly in the basic hard core forestry subjects. There likely will be increasing demand for men with majors in forest management. Also there is and will continue to be increasing need for foresters who are well educated in related fields.

Growing demands for intensified development, protection, and use of all resources on forest lands will require specialized knowledge and substantial education in range, wildlife, recreation, protection, utilization, and multiple use. Future needs may include other related fields. Professional forestry in the federal government could suffer unless there are substantial numbers of foresters with specialized training in related fields.

One purpose of the 1960 standards is to permit schools to turn out foresters in 4 years with major study in related subjects. To permit reasonable scope and diversification in related studies some compromise is necessary in the requirements for forestry courses.

Under the new standards, for example, a forester—range student can take courses in range utilization and range economics rather than forest utilization and economics, but he would still have to have at least 6 hours in each of the other 3 hard core forestry subjects. To require minimum study of even 3 hours in each of the 5 forestry fields would mean sacrificing study in the most significant subjects such as silviculture and forest management. A typical modern 4-year curriculum restricts the amount of study that can be devoted to a variety of related subjects.

A second major change reflected in the 1960 standard is the noncompetitive part for positions titled Forester (Administration). In the Forest Service these include only line positions: assistant district ranger, district ranger, forest supervisor, and regional forester.

This standard allows nonforester members of the professional team, such as range conservationists, wild life biologists, and engineers to serve in administrative line positions, when they qualify as competent forest land administrators. In no way does it affect the standards for staff or specialized for-

ester positions and is not intended for use in examinations. It will be used by the Forest Service only for transfer actions and only when members of these related professional disciplines demonstrate outstanding capabilities as forest land managers. This flexibility is essential to utilize fully the talents of outstanding professional people.

Several members of SAF have suggested the federal government use some title other than "Forester" for line positions in the Forest Service. There are several good reasons for not changing these titles when all alternatives are considered under the Civil Service position classification system. First, forest land management is the predominant activity in each line position; second, use of one title permits definition of orderly, progressive careers for line managers. A third reason is that one title simplifies procedures and limits "paper work."

If more than one title was used, a corresponding number of Civil Service Commission classification standards would have to be used. Many man-months of effort would be required to revise and keep these classification standards current. Costs for this and additional classifications would increase the cost of the personnel program by many thousands of dollars. The use of one classification series is the only economical approach.

The only alternative appears to be the establishment of an administrative series in the general administrative occupational group for the line manager positions. This action would remove the entering requirement of education in forestry and would adversely affect recruitment by government agencies employing foresters and the forestry profession. Such a change would not enhance the professional standing of foresters.

Summary

To summarize, the 1960 hiring standard has simplified and improved recruitment by the federal government. The expensive and confusing two option—two register situation is eliminated.

Although the 1960 standard is more flexible in some ways as compared with the forest option of the previous standard it is more exacting than the forester—range management option. It does not open examinations to nonforesters. No applicant can qualify for the examination without meeting the minimum requirements for college education in forestry.

Almost any weakness that may develop in the application of these standards can be corrected by modifications in the rating process. Forestry graduates with the strongest educational background will receive the highest ratings and earliest offers of appointment.

At present there is not clear justification for changing the noncompetitive part which permits nonforesters to serve in administrative-line positions.

AMERICAN FOREST PRODUCTS INDUSTRIES, INC. TREE FARM PROGRESS REPORT, JULY 1, 1960

State	Number	Total acreage
Alabama	1,631	5,284,333
Arizona	4	70,243
Arkansas	908	3,544,599
California (Redwood)	109	597,354
California (Western Pine)	223	2,143,746
Total California	332	2,741,100
Colorado	8	79,252
Connecticut	50	53,140
Delaware	1	176
Florida	451	5,223,193
Georgia	640	4,853,957
Idaho	663	1,004,309
Illinois	148	17,829
Indiana	318	56,094
Iowa	103	7,237
Kentucky	114	97,162
Louisiana	1,063	3,673,624
Maine	416	301,761
Maryland	25	18,621
Massachusetts	162	67,592
Michigan	695	1,222,140
Minnesota	1,147	629,341
Mississippi	2,389	2,661,940
Missouri	82	147,209
Montana	60	966,798
Nebraska	15	765
Nevada	1	12,984
New Hampshire	255	180,884
New Jersey	24	12,571
New Mexico	4	155,040
New York	167	92,162
North Carolina	551	1,235,657
North Dakota	133	2,437
Ohio	548	115,688
Oklahoma	123	982,375
Oregon (Eastern)	122	1,667,324
Oregon (Western	263	2,441,731
Total Oregon	385	4,109,055
Pennsylvania	547	271,693
Rhode Island	50	7,821
South Carolina	312	1,734,385
South Dakota (Western Pine)	1	20,460
South Dakota (Plains)	177	8,066
Total South Dakota	178	28,526
Total	18,025	53,064,185

Notes and Observations

Control of Cottonwood Insects With A Systemic Insecticide

In recent tests a systemic insecticide has protected young cottonwoods from damage by the twig borer, *Gypsonoma haimbachiana* (Kearf.), and several other insects during the first year of tree growth. Systemic insecticides are introduced into trees by various methods and are carried throughout them by sap movement.

G. haimbachiana is considered the most serious pest of young cottonwoods in the Mississippi Delta Region. By feeding on developing twigs it stunts height growth and causes branching and distortion of the main stem. The insecticide was Thimet, a phosphate ester chemical with the formula *O, O-diethyl S-*(ethylthio) methyl phosporodithioate. When the cuttings were ready for planting they were dipped into a dust containing 44 percent Thimet with activated carbon (44 D). The dust coated the lower 10 inches or more of the 20-inch cuttings, which were planted 15 inches deep. Two test plots were used, each containing 100 treated and 100 untreated cuttings randomized in groups of ten. The spacing was 40 inches between cuttings in each row and 10 feet between rows. Both plots were on well-drained soils, one being Bosket, a very fine sandy loam, and the other being Commerce, a silt loam. Both of these soils are common on the better sites of the Mississippi River Delta.

Observations at the end of the 1959 growing season, 6 months after planting, showed less than one attack by *G. haimbachiana* per 15-inch terminal in the treated plants. Attacks on untreated check plants averaged nearly six per 15-inch terminal (Fig. 1).

The treatment also gave highly significant control and prevention

FIG. 1.—These are 15-inch terminals from 1-year-old cottonwoods. The two at left have been stunted by borer attacks, as is indicated by the close spacing of the leaf scars. Those at right are from trees treated with a systemic insecticide before being planted. Treated terminals of the same age as the untreated ones in the picture would be 26 inches long.

of damage by two leaf beetles, *Chrysomela scripta* F. and *Metachroma* sp.; a clearwing borer, *Paranthrene dollii* (Neum.); and leafhoppers, mostly *Homalodisca coagulata* (Say.) .This leafhopper, the principal vector of phony peach disease, is suspected of transmitting a leaf curl disease that affected the untreated cottonwoods from July through September.

First-year differences in height between the treated and untreated cottonwoods were highly significant. Those on the Commerce soil showed a difference of 3.4 feet in height with average heights of 14.2 feet for the treated plants and 10.8 feet for the untreated. On the Bosket soil, the height difference was 1.1 feet with average heights of 11.2 feet treated and 10.1 feet untreated.

A few plants similarly treated in 1958 were heavily attacked by insects in 1959—an indication that the treatment is not effective after one year.

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Forest Planting Practices Are Often Ineffective

Large-scale planting operations with loblolly pine have been and will continue to be made on recently cutover lands in the Coastal Plain. The time is rapidly approaching when seedlings from seed orchard sources will be outplanted. In Virginia, it is estimated these plantings may begin as soon as 1965. When the time comes, the land managers will surely want to make good use of this superior planting stock. What are the factors that make forest planting more costly, less certain, and assuredly less productive, when compared to old-field plantings?

Logging slash and stumps of harvested trees present barriers to man and machine and prevent precise spacing. Remaining live vegetation reduces survival, early growth, and maximum later growth of the planted trees. These facts

are obvious to all and the treatments used are primarily designed to move obstructions or reduce competition, with tillage often a secondary objective.

The problems of site preparation involve both engineering and silviculture, with the various costs and benefits yet to be evaluated.

A recent survey of forest land plantations at age 3[1] showed the relative effectiveness of cultural practices commonly used in 1955 and still widely used. One-third of the total plantations were bulldozed, one-third disked, and the remainder had no treatment. Logging was carried out on some areas and not on others. Large hardwoods were controlled by chemicals on all but the windrowed bulldozed areas.

The effectiveness of these plantings was seriously reduced by four factors. Alone or in combination, seedling mortality, irregular spacing, overtopping by competition, and unplanned for natural loblolly pine seedlings prevented good utilization of the planting stock. The average loss or ineffective use of planting stock is shown in the following tabulation:

	Per acre
Planted seedlings (estimated)	900
Survival at 3 years	579
Less seedlings clustered	68
Surviving seedlings well-spaced	511
Less well-spaced seedlings overtopped	91
Surviving, well-spaced, free-to-grow seedlings	420
Less well-spaced, free-to-grow seedlings duplicated by free-to-grow natural pine	180
Effective planted seedlings	240

The major loss was mortality, with other serious reductions attributed to competition and the presence of natural seedlings. If natural seedlings are acceptable, 27 percent of the planted seedlings were useful. In case natural regeneration is not acceptable, 53 percent of the planted pines may become a useful part of the young stands. For this higher percent to be useful, the planted pines must outgrow and suppress natural seedlings. This was not evident at age 3 except on a few bulldozed plantations where many natural seedlings were one or two years old.

[1]Trousdell, Kenneth B. Site treatment reduces need for planting at loblolly harvest time. U. S. Forest Service, Southeast. Forest Expt. Sta. Paper 102. 11 pp. 1959.

TABLE 1.—A COMPARISON OF THE BEST AND POOREST UTILIZATION OF 900 PLANTED SEEDLINGS

Factor	Effective planted seedlings per acre			
	Best practices		Poorest practices	
	Number	*Percent*	*Number*	*Percent*
Survived (3 years)	882	98	324	36
Well-spaced	882	100	233	72
Well-spaced, and not overtopped	882	100	133	57
Well-spaced, not overtopped and not duplicated by natural seedlings	829	94	23	17

The figures showing reduction in effectiveness of planted seedlings in the tabulation are average values and as such do not show the range encountered in this survey. The same estimates for each of the 36 plots were reviewed and the best and poorest utilization for each cause-reducing effectiveness in numbers of planted seedlings converted to percent.

With the best usage of planting stock, survival was 98 percent, all were well spaced and free of overtopping competition, and a nearby vigorous natural seedling was not present in 94 percent of the surviving planting stock. With the worst usage of planting stock, the poorest survival was 36 percent, only 72 percent of the surviving planted seedlings were well spaced, 57 percent of the surviving well-spaced were not overtopped, and only 17 percent of the surviving, well-spaced, free-to-grow planted seedlings were placed so that vigorous natural regeneration would not have adequately stocked the planting spot.

These percentages have been applied to a planting rate of 900 per acre to illustrate the wide range of seedling utilization that might have resulted if, on the one hand, everything was done well and, on the other hand, if everything was done poorly (Table 1). These values assume that natural seedlings are accepted as good growing stock.

From actual measurements, the highest number of effective planted seedlings per acre was 550 and the lowest 80. In these case histories the best utilization occurred beneath a pole-sized hardwood stand. There was no ground preparation or logging and large hardwoods were controlled by poisoning. The poorest utilization occurred where a pine sawtimber stand was logged and disked, leaving some large cone-bearing pines and with the large hardwoods poisoned. On the latter plantation, an excellent stand of natural regeneration made planting unnecessary.

This discussion points out the futility of evaluating the success of these forest plantations solely on the number of surviving planted seedlings. Site preparation and hardwood control methods found efficient for natural regeneration were used with only casual control of pine seed dispersal by harvesting. On these plantations the resulting natural pine regeneration often made planting unnecessary and hardwood brush and surviving trees overtopped planted seedlings.

In preparing for the day when seedlings from carefully selected parents will be available, our efforts should be directed toward refining field practices that increase survival; control or eliminate competition; and finally, exclude natural seedlings. Only when these problems are solved is it necessary to concern ourselves with spacing in planting cutover loblolly pine stands.

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Early Growth of Slash Pine on Upland and Wet Sites

Four small plantations on the McNeill Experimental Forest in south Mississippi have provided an opportunity to compare early growth of planted slash pine (*Pinus elliottii*) on bottomland and upland sites.

Two of the sites are upland; one was formerly in cultivation, but had been abandoned about 25 years before it was planted to pine. The other was a nearby cutover site formerly in longleaf pine.

The other two sites have high water tables most of the year. One is a cutover swamp bordering a small stream that provides some drainage. This site formerly supported a mixed stand of slash pine and hardwoods. The other site is locally called a wet meadow. It has no definite water course, and the ground vegetation consists chiefly of sedges and native grasses; trees and shrubs were absent until the pines were planted.

Study Methods

When the study began, in early 1953, all plantations were 6 years old except the one in the cutover swamp, which was 3 years old. The trees had been planted at 6- by 6-foot spacings. Early losses had been light, and stands were fully stocked.

From 1953 to 1955, heights of 25 randomly selected pines in the interior of each plantation were measured at monthly intervals from March to September. In 1956 and 1957, heights were taken at the end of the growing season only. Soil water levels (Fig. 1) were measured monthly through the growing season from 1953 through 1955. Rainfall records at McNeill, Miss., indicated that deficiencies of 6.76 to 22.80 inches per year accrued in 4 of the 5 years; 1953, with 4.09 inches above normal, was the only exception.

Soils were collected and analyzed in 1957 (Tables 1 and 2). The two upland soils are similar except that the subsoil on the old field has more clay and less sand than that on the cutover upland. The differences due to previous cultivation and fertilization of field crops were not determined. In the wet meadow, both surface soil and subsoil have a very high sand content, and are very low in nitrogen and mineral nutrients—two of the three samples had no phosphorus at all. In the cutover swamp, the surface soil is a muck and the subsoil organic loamy sand. The surface soil exceeds that of the meadow in organic content, nitrogen, and minerals.

Results

In 1953-1955, height growth began between March 1 and March 15 on all four planting sites. It was 55 percent complete by May 1, 90 percent complete by July 1, and 95 percent complete by August 1 (Fig. 1). The period required to complete about 95 percent of the annual height growth ranged from 136 days in 1953 to 164 days in 1955. The average was 152 days. Growth periods were about the same on all sites.

When observations began, pines on the old field averaged 18.4 feet tall and those on the cutover site 13.4 feet (Fig. 2, Table 3). During 1953, height growth of the sample trees averaged 4.0 feet on the old field and 3.7 feet on the upland cutover site. In the next 4 years, growth was greater on the cutover site than on the old field site, but at age 11 the old-field pines were still taller than those on the cutover upland. The cause of the declining growth rate on the old field was not determined, but may be related to competition among the larger trees on this site.

Since the second growing season after planting, tree needles in the

(*Continued on page 725*)

TABLE 1.—TEXTURE AND MOISTURE PROPERTIES[1] OF SOIL SAMPLES FROM SLASH PINE PLOTS

Site and soil	Depth of sample	Texture	Mechanical composition			Moisture constants by weight		
			Sand	Silt	Clay	Moisture equiv.	Wilting point	Available water[2]
	Inches		—*Percent*—			—*Percent*—		
Old field,	4	Sandy loam	64	21	15	17.2	2.8	14.4
Orangeburg soil	20	Sandy clay loam	48	21	31	22.0	6.7	15.3
Cutover upland,	4	Sandy loam	65	21	14	16.5	3.3	13.2
Norfolk soil	16	Sandy clay loam	60	19	21	17.0	5.9	11.1
Swamp,	4	Muck	0	0	0	67.3	29.0	38.3
Johnston soil	30	Organic loamy sand	34	31	35	39.3	15.8	23.5
Wet meadow,	4	Organic loamy sand	80	15	5	19.3	7.5	11.8
Plummer soil	30	Sandy loam	72	19	9	17.9	2.7	15.2

[1]Analyses made by Robert Zahner, formerly of the Crossett Research Center, Southern Forest Expt. Sta.
[2]Difference between moisture equivalent and wilting point.

TABLE 2.—CHEMICAL ANALYSIS[1] OF SURFACE SOILS (0- TO 4-INCH DEPTHS) FOR TWO WET SITES

Site	Sample	Organic content	pH	P_2O_5	N	Milliequivalent in 100 grams			
						K	Ca	Mg	Exchange capacity
		Percent		*Ppm*	*Percent*				
Wet meadow	First	4.26	4.25	0	0.18	0.03	0.25	0.94	7.63
	Second	10.34	4.30	45.21	.41	.05	.36	1.02	17.39
	Third	2.15	4.28	0	.13	.04	.30	.52	3.72
Swamp	First	27.46	4.48	59.06	.76	.20	1.78	1.62	32.16
	Second	37.75	4.32	97.42	.72	.21	2.91	2.80	44.60
	Third	39.18	4.10	155.40	1.25	.29	1.39	2.17	43.49

[1]Made by Marvin Gieger, Chemistry Department, Agric. Expt. Sta., Mississippi State College.

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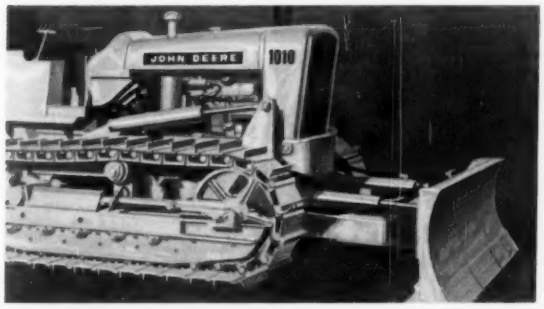

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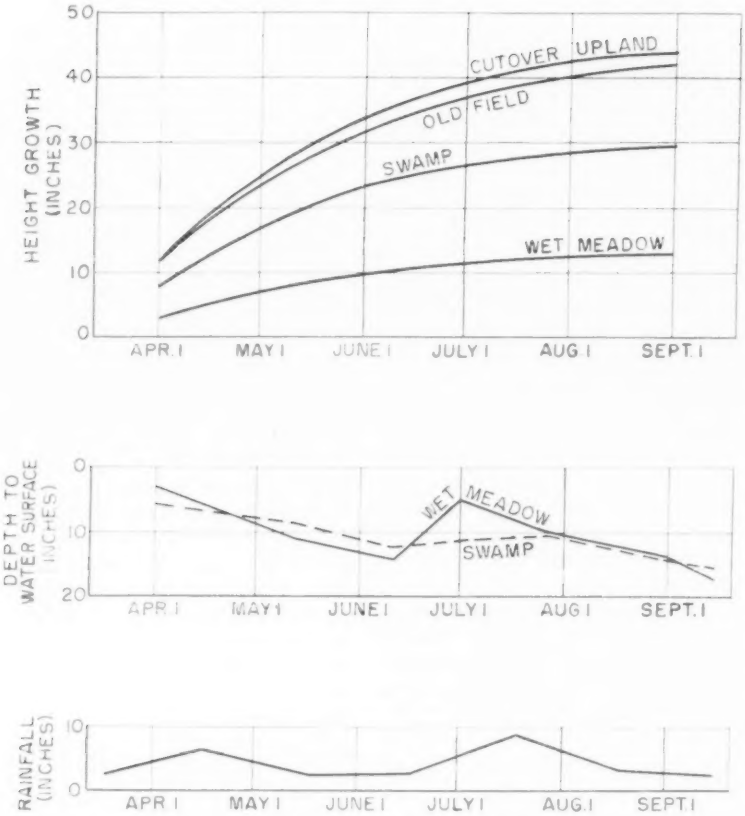

FIG. 1.—Three-year averages of cumulative slash pine height growth, ground water levels for wet sites, and rainfall.

wet meadow have been pale and stunted, an indication of low vigor. The pines in the swamp have always had thrifty, dark green foliage. Annual height growth during 1953-1957 averaged 1.2 feet in the meadow and 2.7 feet in the swamp. At ages 11 and 8 years for the meadow and swamp plantations, respectively, height of sample trees averaged 11.2 and 18.8 feet.

TABLE 3.—AVERAGE ANNUAL HEIGHT GROWTH OF PINES ON FOUR SITES, 1953-1957

Site	Average total height, March 1, 1953	1953	1954	1955	1956	1957	Average	Growth as proportion of that on cutover plot
	Feet							*Percent*
Old field	18.39	4.0	3.7	3.0	3.4	2.9	3.4	90
Cutover upland	13.41	3.7	4.2	3.4	4.1	3.7	3.8	100
Swamp	5.16[1]	2.8	2.3	2.4	2.7	3.5	2.7	72
Wet meadow	5.06	.9	1.2	1.1	1.4	1.6	1.2	32

[1]The swamp planting was 3 years old in 1953, the others 6 years old.

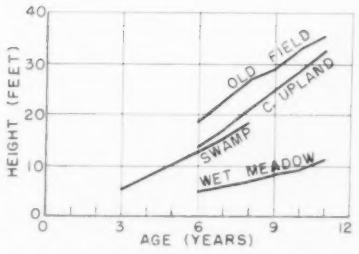

FIG. 2.—Total tree heights, by age in plantation.

During the 5 years of the study, the wet meadow plantation averaged 32 percent, and the swamp plantation 72 percent, of the height growth on the upland cutover site (Table 3).

As the water table was about equally high on both wet sites (Fig. 1), it is likely that the poor growth in the meadow is caused by the relatively infertile soil. This assumption is supported by a small unreplicated test in which the application of fertilizer to some of the trees in the wet meadow produced a striking increase in growth and foliage color.

By the soil-site classification developed by Barnes and Ralston[1] for slash pine plantations in Florida, the wet meadow has a site index at age 25 of about 30 feet, the swamp 55, the cutover upland 65, and the old field 70. The McNeill old field and cutover upland sites compare favorably with the best Florida sites.

L. F. SMITH
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New Orleans, La.

[1]Barnes, R. L., and C. W. Ralston. Soil factors related to growth and yield of slash pine plantations. Fla. Agric. Expt. Sta. Bul. 559. 23 pp. 1955.

Points of View

Technical Training for Nonprofessional Field Personnel in Forestry and Conservation

In past months the JOURNAL OF FORESTRY has carried some lively and stimulating discussions on nonprofessional technical training in forestry and other phases of resource management.[1] No clearly defined role for vocationally trained personnel has emerged as yet in this country. Employing organizations are less advanced in this respect than many educators but even here no clear definitions have been developed.

As our society becomes increasingly complex we must rely to a greater extent than ever upon technical skills and knowledge to perform precise management operations. In the dynamic situation present today technical knowledge is being discovered and applied at an accelerating rate though we are training scientists and professional men considerably less rapidly. To bridge this gap between highly skilled manpower, many professions have begun to train people at the technician level defined as one skilled in technical details and techniques of a subject or art) as distinguished from the technologist (one skilled in systematic [scientific] knowledge of an industrial or agricultural science or art). Medicine, dentistry, engineering are all developing technician training programs in order to make the most effective use of highly trained people.

Essentially the technician is given a short course in the technical processes and practices needed to supplement or carry out the operating programs developed and supervised by the professionally trained man. The latter engages in the conceptual, managerial, and program planning work while the former is at the level of direct application of many technical practices. He must understand technical terminology and processes but it is not essential that the technician know the basic sciences governing the field. A good garage mechanic (technician) knows every part of an automobile and how to repair it and keep it operating. He usually is not required to know the laws of physics and thermodynamics governing a gasoline motor such as that possessed by a mechanical engineer.

In forestry, wildlife management, and soil conservation, we are in the process of recognizing the need for supplementing professional manpower with less highly trained but skilled manpower. Except for the ranger school graduate who is a high type of trained technician, most of our supplementary technical personnel is drawn from local experienced men who have had no formal technical training. Their skills are limited to those learned on the job from working under a professional man. Recent studies are showing that wherever a supply of skilled nonprofessional manpower is absent, professional men are spending far too much time on routine jobs. This happens to be the case in many of our resource management programs—public and private. Until now professional foresters, wildlife managers, and soil conservationists have been reluctant to examine nonprofessional training realistically. A major reason may be the absence of a clearly defined role for the nonprofessional but technically trained man which the current discussion in the JOURNAL and elsewhere will go far toward clarifying.

Several important aspects of nonprofessional technical training need to be considered more closely, including job classification and training. Employers with forestry programs are now beginning to establish regular job descriptions for the aides, and field assistants who work under the supervision of professionally trained men and who carry out a number of practical field duties. The Civil Service Commission is in the process of establishing a Forestry Technician classification for able men who become proficient in field skills. These skills have been learned through practical experience on the job, in-service training schools, and self study—though no formal home study courses have been available until recently.

Formal residence training in these vocational-technical skills where a man could learn a variety of field practices under supervised instruction has been limited until recently to the two ranger schools —New York State Ranger School at Wanakena, N. Y. (under the supervision of the New York State College of Forestry) and the State Ranger School at Lake City, Fla. (under the University of Florida). The new Woodsmen's Training Course at the North Central Agricultural School (sponsored by the University of Minnesota) at Grand Rapids, Minn., is essentially a short course (12 weeks) on the order of the ranger schools which have one- or two-year courses. It is not clear at what level the nonaccredited, semiprofessional courses in forestry, conservation, etc. given at teachers and other colleges may be finally classed—professional, semiprofessional or subprofessional. These are neither professional nor subprofessional, and usually not accredited by the professional societies. The current study by the Society of American Foresters of forestry education will go far toward clarifying many of these re-

[1] Hardee, Jay H. Comments on "What kind of forestry schools?" Jour. Forestry 57:761-762. 1959; John W. Duffield. What kind of forestry schools? Jour. Forestry 57:374-375. 1959; Kenneth P. Davis. Should we develop a dual system of forestry education? (Council's Column). Jour. Forestry 57:381-382. 1959.

lationships and establishing professional residence school standards.

There still remains a major problem of providing educational opportunity to the man who is on the job or a great distance from residence training facilities and to the young man unable to attend a four-year course. Residence training for extended periods is often not possible and in-service instruction usually limited to a single specialized field. In some cases high school vocational agricultural courses are adapting their curricula to include forestry and/or soil conservation. Over the years men in other fields have had a wide variety of well-developed and soundly based home study (correspondence) courses. Unfortunately, the fields of forestry, soil and water, and wildlife conservation have not had any responsible, accredited correspondence courses at the vocational level.

In order to fill the need for technically sound vocational training courses by correspondence, the National School of Forestry and Conservation was organized in early 1958. Using the Study Guide system of the Armed Forces Institute, the school offers three complete courses—forestry, soil and water conservation, and fish and wildlife conservation. An examination follows each lesson with questions so worded that direct copying of answers is not possible. A final field-written examination may be taken either at the school's camp or on the job under the supervision of a professional forester, wildlife biologist, or soil conservationist approved by the school. The school operates an intensive two weeks' field training course at Wolf Springs Forest near Minong, Wis., for those students without field experience. A certificate is awarded to the student in recognition of successful completion of his work. It has been fully accredited by the State of Wisconsin's Department of Public Instruction under standards considered the most rigorous in the United States. The National Home Study Council refers inquiries to the National School of Forestry and Conservation as do numbers of private and public forestry and conservation organizations. The school has been approved by the Veterans Administration for G.I. Training.

Conclusions

Nonprofessional technical personnel are finding an increasingly important place on field assignments where a knowledge of practical skills is required. They are being given greater recognition by employers. Residence training facilities are limited to in-service schools, to ranger school type training (mainly in forestry) as well as some vocational high school level instruction in soil conservation and forestry. It is not clear as yet just where the nonaccredited semiprofessional 4-year college course fits into the over-all structure. One means of providing a wider group of skills to men on the job and others unable to take time for residence training is through correspondence study from accredited home study schools.

To assure availability of high calibre nonprofessional technical training, professional resource managers will need to give increasing recognition and job opportunities to men trained as nonprofessional field technicians. Professional societies may well wish to establish accreditation standards for schools and provide recognition for nonprofessional technical status in professional societies.

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and CHARLES G. GELTZ
School of Forestry, University of Florida, Gainesville participating in administration of National School of Forestry and Conservation

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Book Reviews

This Land of Ours

By Alice Harvey Hubbard. 270 pp. The Macmillan Company, New York. 1960. $4.95.

A majority of one is often "enough people" to materialize and implement conservation and other beautification projects on the community level. Armed with this theory, Alice Harvey Hubbard suggests over 150 down-to-earth projects on conservation "how-to."

Mrs. Hubbard's affluent conservation pen keeps in bounds of the quote by erudite conservationist President Teddy Roosevelt—"Do what you can, where you are, with what you've got"—in her illustrative accounts and recounts of how individuals and organizations may easily foster resource improvement projects on their own homesites and communities. Included are anti-billboard campaigns, preservation of roadside trees, establishment of recreation areas, improvement of the ole swimmin' hole, planting and management of town forests, and many others. Her range of subject treatment is wide; the potted home garden box and international cooperative conservation projects are similarly discussed.

Enough diversity of projects exists to inspire even the most unimaginative and dormant conservationist to activity.

The author has viewed conservation practices extensively in Europe and the United States, and knows full well the value of good management for our soil, water, and forest resources. She precludes many project discussions with interesting narratives of existing resource heritage and examples of what has already been done to maintain and improve them. Resource conservation, per se, is cursorily but understandably discussed in theory and application.

This Land of Ours belongs on the library shelves of groups and individuals whose flurries of interest for "doing" conservation projects are often interspersed with long periods of apathy and inactivity because of the lack of know-how. Foresters can learn from it, too.

Alice Harvey Hubbard gives that needed squeeze to trigger action.

C. W. Mattison
U. S. Forest Service and President, Conservation Education Association

Recreational Use of Wild Lands

By C. Frank Brockman. 346 pp. Illus. McGraw-Hill Book Co., Inc., New York. 1959. $8.50.

Brockman's monumental work on the importance of recreation in wild land management is a solid and lasting contribution to literature in this field. It is not a publication for light reading, but crammed with facts on the subject which indicates exhaustive and intensive research. The volume will remain as a source book in research libraries for many years, and of course will serve as a text on the scope of recreation on wild lands.

The comprehensive nature of this work will give it a lasting place in the field, and it should be of great value to research people in the National Organization of Recreational Resources Review Commission studies. NORRRC reports may supplement parts of this book, but it is doubtful if they will supplant it.

The section on Wildland Recreational Areas in Other Lands is unique and thorough, showing how far the field of outdoor recreation has spread, and the adaptations other peoples make to fit their local situations. The total listing is impressive.

Many currently active facets of recreational use are mentioned, and while the immediate growth and expansion in such fields as boating, camping, and use of house trailers have boomed since World War II, such spurts in specific uses are to be anticipated as the normal pattern, and need not carry special recognition in the context of this book. Actually, the book is encyclopedic in the breadth of coverage.

The section on the Economics of Recreational Travel is good and represents the first attempt to indicate the scope of this approach in any forestry field text. Travel agencies, tourist bureaus and chambers of commerce have been the usual authorities on this subject. However, the topic is so important it is heartening to see it given recognition in this publication.

This is a solid book—one to study and not to scan or dip into for pleasure. It well repays critical reading.

Lemuel A. Garrison
Superintendent, Yellowstone National Park

The Forestry Handbook for British Columbia

2nd ed. By The Forest Club. 800 pp. Illus. University of British Columbia, Vancouver 8, B. C. 1959. No price indicated.

The second edition of *The Forestry Handbook for British Columbia* is a greatly expanded version of the first book published in

1953, being over twice the size of the first edition.

The *Handbook* covers the forestry field under six main divisions: namely, Forest Harvesting, Wood Products, Forest Measurement, Resource Management, Silvics and Silviculture, and Forest Protection.

Engineering, logging, log scaling and grading, and logging safety are dealt with under Forest Harvesting. Wood technology, lumbering, veneer and plywood, wood pulp manufacture and other wood manufacture, such as composition boards and laminated wood are dealt with under Wood Products. Basic statistical measures, forest sampling, volume tables, data processing, and photogrammetry are contained under the division of Forest Measurement. The field of forest, range, wildlife, and watershed management is covered under the main Resource Management division. This division also contains sections on parks and recreation, and forest ownership and disposal. Forest ownership and disposal covers the various methods of tenure existent in British Columbia, together with applicable taxes and appraisal methods. This division ends with the inclusion of useful compound interest and discount tables. Tree identification, silviculture practice, forest genetics, silvical characteristics, and forest classifications make up the division of Silvics and Silviculture. Protection against fire, insect, and disease is covered under the main division of Forest Protection.

The *Handbook* concludes with a division on General Information, including sections on bush craft and survival, first aid, British Columbia forest resources, the profession of forestry, a directory of equipment, and conversion factors.

The *Handbook* is well written. The written material is supported by illustrations and useful charts, diagrams, and tables.

As in the first edition, the *Handbook* is the creation of the student members of the Forest Club of the University of British Columbia. Members of the faculty acted as advisers on the publication. The quality of the work appears to compare favorably with any handbook publication for its respective field.

The *Handbook* was compiled for British Columbia practice. Volume tables, tree identification, silvical characteristics, and forest classifications and such similar sections that would be applicable to one forest region have been written and illustrated for British Columbia conditions. With the aid of similar information for other forest regions, the *Handbook* becomes a useful tool for forest practice in any forest region in the world.

C. D. SCHULTZ
C. D. Schultz & Company Limited, Vancouver, Canada

Complete Field Guide to American Wildlife

By Henry Hill Collins, Jr. 683 pp. Illus. Harper & Brothers, New York. 1959. $6.95.

Here is a useful and usable guide to all forms of wildlife naturally inhabiting the eastern, central, and northern parts of America. Every species of birds, mammals, reptiles, amphibians, fishes, and shore life is described.

Some 2,000 illustrations and maps are included. More than 700 species are shown in full color.

Primarily an identification handbook, it also provides in condensed form essential information on life habits, habitats, food, and, where appropriate, voice. Comparison charts are inserted for ready field use in distinguishing similar species.

Ira N. Gabrielson, president of the Wildlife Management Institute, served as chairman of the book's editorial advisory board. He pronounces it "a superb job and one that should be widely used by all outdoor enthusiasts."

The illustrations are by talented wildlife artists. The advisory board assures scientific accuracy. Recommended.

HENRY CLEPPER

The Forest and The Sea

By Marston Bates. 277 pp. Random House, Inc., New York. 1960. $3.95.

In a philosophical way, the author of *The Forest and The Sea* answers in a fascinating discussion of biological relationships found in nature, the question of "what good is it," or better yet, "what is its role in the economy of nature?"

When I first saw the title, I wondered just what possible relationship could be worked out between the forest and the sea. The three-dimensional character of both is the basis of the analogy. Man's point of view, however, is reversed. In the forest he is a bottom animal; whereas, in the sea—a surface animal. Unfortunately, as yet there is no "aqualung" for interarboreal space and, therefore, knowledge of this interesting zone is limited.

Starting with the origin of life in the sea, the author moves logically, for me at least, through the coral reef, lakes and rivers, and the rain forest to woodland, savanna, and desert. Along this road the reader cannot but develop an ecological conscience.

When he comes to man, he assumes that the economy of nature and the ecology of man are inseparable. Man's destiny is tied to nature's destiny, and the arrogance of the engineering mind does not change this.

I particularly like the statement that established biological communities—the climax communities of the ecologists—are not readily penetrated by new species of animals and plants. This would be well for us to remember when thinking of introducing new tree species into present established forest types; most certainly, when considering introduction of game birds and animals from foreign countries into our present established habitat communities.

The Forest and The Sea is not a book that would normally be chosen for reading by foresters. However, I found it delightfully fascinating, refreshing, and informative. I think it a good thing to get away from the humdrum of

forestry literature, at least occasionally. This book will intrigue you philosophically, and enlighten you biologically. The wise principle of coexistence between man and nature, even if it be a modified kind of man and a modified kind of nature, is the biologist's multiple use.

HOWARD A. MILLER
U. S. Forest Service, Atlanta, Ga.

The Role of Quality in the Eastern White Pine Industry

By John Fedkiw, Neil J. Stout, and Frederick S. Hopkins. 20 pp. Illus. State University College of Forestry at Syracuse University, Syracuse, N. Y. 1960.

Four articles dealing with eastern white pine lumber quality, which originally appeared in the *Northeastern Logger,* and written primarily with the integrated lumber manufacturer in mind, have been made available in this pamphlet. The authors consider the problem that declining white pine timber quality poses for northeastern lumber manufacturers, and eventual solutions to the problem through forest management.

The first two articles sketch the production and price trends that have developed over past decades, giving the reader information necessary to an understanding of the genesis of the quality problem. The authors indicate that marked changes have taken place in total production, average grade yield, uses, and prices of white pine lumber. As a result of these changes, processers have had to manufacture increasing proportions of low-quality lumber that is difficult to move and adds little to profits. Unfortunately, the industry cannot easily reduce the low-quality component of its production. Lumber grade yield is dictated almost completely by the quality of white pine timber available for processing.

In the last two articles of the series two forest-management activities are considered for their long-run potential in improving timber quality. Results at the Pack Demonstration Forest are cited as an example of the increase in timber quality likely to result from intermediate improvement cutting. This management tactic is judged to be effective only in shifting some low common yields to middle common grades, thus having a noticeable but not striking influence on quality. Pruning is offered as a more profitable and faster means for quality improvement, since shifts in lumber grade yield are more marked and occur more quickly after treatment.

Although not exhaustive in treatment, these papers clearly outline some major aspects of the eastern white pine timber quality problem and analyze two timber-management techniques for its eventual solution. In addition, the series is an admirable study of the close relationship which exists between a wood-using industry, the ultimate consumers it attempts to serve, and the forest resource upon which it is based. Thus this pamphlet will be profitable reading not only for those directly concerned with white pine management but also for the many foresters who desire a better understanding of how their decisions and actions influence, and are influenced by, events in large segments of the economy.

ROBERT MARTY
Northeastern Forest Experiment Station, Forest Service, U. S. Department of Agriculture, Upper Darby, Pa.

Publications of Interest

After many years of screening a large number of audio-visual materials and making evaluation of their usefulness as educational aids at the elementary, junior high school, and senior high school levels, the Audio-Visual Department of The Conservation Foundation has compiled and edited *A Critical Index of Films and Filmstrips in Conservation.* This publication is an index of films and filmstrips dealing with renewable resources, nonrenewable resources, and new and to-be-developed resources, and may be obtained without charge from the Foundation, 30 East 40th Street, New York, N. Y.

* * *

The new 8th edition of the *Forest Farmers Manual* has been issued by the Forest Farmers Association, Atlanta, Ga. It presents for the first time comprehensive coverage of the business end of forest farming—from the investment of money to taxes and regulatory legislation such as the fair labor standards act and social security.

In addition to the new section on business, the 1960 *Manual* presents also for the first time two important keys to timber growing in the South. The first is a key to commercial trees of the southern forest, prepared by W. B. DeVall, head of the Department of Forestry, Auburn University. The second is a key to southern forest tree insects, based on damage symptoms, prepared by R. J. Kowal, B. H. Ebel, and E. P. Merkel, entomologists of the Southeastern Forest Experiment Station. For the past several years the *Manual* has presented a key to the diseases of southern forest trees.

The 176-page *Forest Farmrs Manual* is edited by J. Walter Myers, executive director of Forest Farmers Association and editor of *Forest Farmer* magazine. Price: $4.00.

* * *

National Forest Vacations, currently one of the U. S. Department of Agriculture's most popular publications, is out in revised form.

The new edition emphasizes the national forest recreation potential, in keeping with the increased development and rehabilitation of camping and picnicking facilities under the Forest Service's five-year recreation program, Operation Outdoors, which started July 1, 1957.

One of the revised sections in the booklet is "Guide to Your National Forests," a state-by-state description of all national forest areas with attractions, facilities, and nearby towns listed. Roads, camping sites, picnic grounds, and boating and swimming facilities are detailed.

Single copies may be obtained from the Forest Service, U. S. Department of Agriculture, Washington 25, D. C.

Current Literature

Compiled by LOIS MCALLISTER, *Assistant Librarian, State University College of Forestry at Syracuse University Range Management Section Compiled by* NELLIE G. LARSON, *Library, U. S. Department of Agriculture*

General

The Redwoods. Rev. by R. St. B. Baker. 160 pp. Illus. George Ronald, London, England. 1959. 21s. Famous Trees Library No. 1.

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Progress in Watershed Management; Proceedings of Third Annual Meeting, September 21, 1959. 120 pp. Illus. Arizona State Land Dept., Watershed Management Div., Phoenix, and Arizona Water Resources Committee. 1960.

Proposed Program for Watershed Management Research in the Lower Conifer Zone of California. By H. W. Anderson. 21 pp. Maps, tables. Pacific Southwest Forest and Range Expt. Sta., Berkeley, Calif. 1960. Tech. Paper No. 46.

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Dwarfmistletoe of the Intermountain and Northern Rocky Mountain Regions and Suggestions for Control. By J. W. Kimmey and D. P. Graham. 19 pp. Illus. Intermountain Forest and Range Expt. Sta., Ogden, Utah. 1960. Res. Paper No. 60.

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Costs and Benefits of Reseeding Range Lands in Southern Idaho. By D. D. Caton and C. Beringer. 31 pp. Illus. Ref. Idaho Agric. Expt. Sta., Moscow. May 1960. Bul. No. 326.

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Bibliography of Wood-Moisture Relationships. By C. J. Kozlik. 35 pp. Oregon For. Products Res. Center, Corvallis. 1960.

Factors Related to Variation of Specific Gravity in Young-Growth Douglas-Fir. By M. D. McKimmy. 52 pp. Illus. Oregon For. Products Res. Center, Corvallis. 1959. Bul. No. 8.

The Fine Structure of the Pits of "Eucalyptus regnans (F. Muell.)" and Their Relation to the Movement of Liquids into the Wood. By J. Cranshaw. pp. 52-56. Plates. Australia Commonwealth Scient. and Indus. Res. Org., Melbourne. 1960. Div. of For. Products Reprint No. 390.

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The Wood Anatomy of Malayan Timbers: Commercial Timbers . . . Light Hardwoods. By P. K. Balan Menon. 30 pp. Federation of Malaya, Ministry of Agric., Kuala Lumpur. 1959. Malayan For. Res. Institute Res. Pamphlet No. 27.

Society Affairs

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1960-1961

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Missoula, Mont.

Sixtieth Annual Meeting

Society of American Foresters

Washington, D. C., November 13-16, 1960

The forestry profession will celebrate sixty years of organized progress at the annual national meeting of the Society of American Foresters, scheduled for November 13-16 at the Sheraton-Park Hotel in Washingnton, D. C.

The theme will be "Forestry's Expanding Horizons."

More than 1,000 foresters from the United States and Canada are expected. Some 70 papers will be presented at 12 different sessions on subjects ranging from forest tree genetics to wood technology.

Three keynote speakers will be featured. U. S. Forest Service Chief Richard E. McArdle will review the past sixty years of forestry and predict future developments in the profession. William C. Bramble, head of the Department of Forestry and Conservation at Purdue University, will discuss the past sixty years of forestry from the standpoint of its sociological aspects and the future uses of forests. William M. Bailey of International Paper Company will analyze the scientific achievements of professional forestry with special reference to industrial forest management.

At the Society's annual dinner, to be held on the evening of November 16, three special awards will be presented by President Charles A. Connaughton of San Francisco. These are the Sir William Schlich memorial medal and the Gifford Pinchot medal, both given for outstanding contributions to forestry; and the award for achievement in biological research contributing to the advancement of forestry. The address of the evening will be given by Howard A. Meyerhoff, executive director of the Scientific Manpower Commission, Washington, D. C.

President Connaughton has announced that all foresters and friends of forestry everywhere, whether members of the Society or not, are welcome to attend the various sessions and the sixtieth anniversary dinner.

"This 1960 meeting of the SAF follows closely after the Fifth World Forestry Congress scheduled for Seattle in August and September," he said. "These two important gatherings of foresters will emphasize the meritorious services which forestry and professional foresters are rendering to the stability and strength of our nation. Few professions in America have come along as rapidly as has forestry in the past sixty years."

The foresters return to the nation's capital this year for their annual meeting in keeping with a policy of commemorating every decennial anniversary of the Society's founding in Washington, D. C. in 1900.

Ladies Activities

A large enrollment of ladies is expected at the meeting. They will enjoy a full program of special events. The

RICHARD E. MCARDLE

Ladies Committee has arrangements well along and many special surprises await the visitors.

Scheduled events include a conducted tour on Monday, November 14, to the Custis-Lee Mansion in Arlington National Cemetery, to see the impressive ceremony at the Tomb of the Unknown Soldiers, and to Mount Vernon.

Tuesday, November 15, will feature a special visit to the White House, and an embassy tour concluding with a tea at the Embassy of the West German Republic.

Wednesday, November 16, will include a luncheon at the beautiful Columbia Country Club in suburban Maryland.

The Committee is planning a number of "extras" that will please the visitors and make their visit to the sixtieth anniversary meeting one of the best.

Schedule of Events

Sunday, November 13

SAF Council meeting: morning.

Joint meeting of the Council and Section delegates: afternoon.

Editorial Board, JOURNAL OF FORESTRY: afternoon.

Association of Consulting Foresters: evening.

Monday, November 14

General Session: morning.

Society Affairs Session: afternoon.

Alumni functions (no scheduled SAF meetings): evening.

Motion pictures: evening.

Tuesday, November 15

Division of Silviculture: morning and afternoon.

Division of Forest Products: morning.

Division of Economics and Policy: afternoon.

Division of Forest Recreation: morning.

Division of Forest-Wildlife Management: afternoon.

Alumni functions (no scheduled SAF meetings): evening.

Wednesday, November 16

Division of Forest Management: morning and afternoon.

Division of Education: morning.

Division of Range Management: morning.

SAF Council meeting: afternoon.

Division of Watershed Management: afternoon.

SAF dinner and dance: evening.

General Meeting

Monday morning, November 14

Henry J. Malsberger, Chairman
Theme: "Forestry's Expanding Horizons"

1. Welcome by the President, Charles A. Connaughton.

2. "Horizons Unlimited." Richard E. McArdle, U. S. Forest Service, Washington, D. C.

3. "Industry's Effect on Forest Management." William M. Bailey, International Paper Company, Panama City, Fla.

4. "Forestry and Sociologic Changes in the 20th Century." William C. Bramble, Department of Forestry and Conservation, Purdue University, Lafayette, Ind.

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Society Affairs Session

Monday afternoon, November 14

Charles A. Connaughton, President
Henry J. Malsberger, Vice President
Henry Clepper, Executive Secretary

1. Report of the President.
2. Report of the Executive Secretary.
3. Report of the Editor of Society publications, Arthur B. Meyer.
4. Report of the Editor of Forest Science, John W. Duffield.
5. Report of the Committee for the Advancement of Forestry Education, Frank H. Kaufert, chairman.
6. Report of the Committee on Civil Service, R. J. Preston, Jr., chairman.
7. Report of the Committee on State Registration and Licensing, Archie E. Patterson, chairman.
8. Report of the Committee on Forestry Research, George M. Jemison, chairman.
9. Report of the Committee on International Relations, V. L. Harper, chairman.

Special Program on Forestry Education

Samuel T. Dana, leader.

This portion of the afternoon session will be devoted to a discussion of forestry education. Participation by the members in the audience is invited.

Division of Silviculture

Tuesday morning, November 15

Jesse H. Buell, Chairman
Paul O. Rudolf, Vice Chairman
Frank W. Woods, Secretary

1. "Loblolly Pine Growth as Re-

lated to Site, Age, and Stand Density." Thomas C. Nelson, Southeastern Forest Experiment Station, Asheville, N. C.

2. "Direct-Seeding Comes to the South." William F. Mann, Jr., Southern Forest Experiment Station, Alexandria, La.

3. "Fungi Associated with Viability Losses of Sugar Pine Seed During Cold Storage." Gilbert H. Schubert, Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.

4. "The Town Creek Ponderosa Pine Plantations." James D. Curtis, Intermountain Forest and Range Experiment Station, Ogden, Utah, and Melvin A. Coonrod, U. S. Forest Service, Ogden, Utah.

5. Division business meeting.

Tuesday afternoon, November 15

1. "Energy Flow Silviculture, a New Concept for Forestry." Frank W. Woods, School of Forestry, Duke University, Durham, N. C.

2. Report of the SAF Committee on Natural Areas. John F. Shanklin, Office of the Secretary, U. S. Department of the Interior, Washington, D. C.

3. "Estimating Site Index for Longleaf Pine through Quantitative Evaluation of Associated Vegetation." Earl J. Hodgkins, Department of Forestry, Auburn University, Auburn, Ala.

4. "Factors Affecting the Development and Survival of Sugar Maple Sprouts." Thomas W. Church, Jr., Lake States Forest Experimental Station, St. Paul, Minn.

5. Report of the SAF Committee on Forest Tree Improvement. R. T. Bingham, International Forest and Range Experiment Station, Moscow, Idaho.

6. "Discriminant Analysis of *Pinus thumbergii* × *Pinus densinflora* Hybrids." Francois Mergen and G. M. Furnival, School of Forestry, Yale University, New Haven, Conn.

Division of Forest Products

Tuesday morning, November 15

Rudolph F. Grah, Chairman
Harvey D. Erickson, Vice Chairman
Raymond J. Wood, Secretary
Theme: "The Decade 1960—A Period of Change in Wood Use?"

1. "What Is Ahead in the Lumber Industry?" Arthur F. Muschler, Edward Hines Lumber Company, Chicago, Ill.

2. "What Is Ahead in the Pulp and Paper Industry?" George B. Amidon, Minnesota and Ontario Paper Company, International Falls, Minn.

3. "What Is Ahead in the Plywood and Hardboard Industries?" James Bethel, National Science Foundation, Washington, D. C.

4. "Wood Production and Processing in the Years Ahead." James J. Byrne, Division of Forest Products Research, U. S. Forest Service, Washington, D. C.

5. "Forest Products Mix in a Changing Economy." John A. Zivnuska, School of Forestry, University of California, Berkeley, Calif.

Division of Forest Recreation

Tuesday morning, November 15

William A. Parr, Chairman
Henry A. Harrison, Vice Chairman
Lemuel A. Garrison, Secretary

1. Opening Remarks. William A. Parr, Chairman.

2. "Widening Horizons in Forest Recreation." DeWitt Nelson, California Department of Natural Resources, Sacramento, Calif.

3. "What Should the User Pay for Forest Recreation." John Sieker, Division of Recreation and Land Uses, U. S. Forest Service, Washington, D. C.

4. Panel Discussion: "Recreation for the Future."

Moderator, Francis W. Sargent, Outdoor Recreation Resources Review Commission, Washington, D. C.

"The Public's Viewpoint." Kenneth B. Pomeroy, American Forestry Association, Washington, D. C.

"State Parks." Maurice K. Goddard, Pennsylvania Department of Forests and Waters, Harrisburg, Pa.

"Industry." Frank A. Albert, St. Regis Paper Company, Jacksonville, Fla.

"U. S. Forest Service." H. W. Camp, Forest Recreation Research, U. S. Forest Service, Washington, D. C.

"National Park Service." Allen T. Edmunds, Division of Recreation Resource Planning, National Park Service, Philadelphia, Pa.

"Fish and Game." Harry R. Woodward, Department of Game, Fish, and Parks, Pierre, S. Dak.

Discussion.

5. Election of officers.

Division of Economics and Policy

Tuesday afternoon, November 15

H. R. Josephson, Chairman
Henry H. Webster, Secretary
Symposium: "Investment Opportunities in Forestry"

1. "Methods for Appraising Investment Opportunities in Forestry." Carl H. Stoltenberg, Department of Forestry, Iowa State University, Ames, Iowa.

2. "How Forest Industries Judge Investment Opportunities." Arthur W. Nelson, Jr., Timber Products Division, Champion Pulp and Paper Company, Hamilton, Ohio.

3. "Timber Investments from the Standpoint of Institutional Lenders." Eli Ferguson, Equitable Life Assurance Society of the United States, New York, N. Y.

4. "Forest Investment Opportunities and Problems in Canada." David A. Wilson, International Pulp and Paper Company of Canada, Montreal, P. Q., Canada.

5. Summary and Evaluation. Ronald I. Beazley, Department of Forestry, Southern Illinois University, Carbondale, Ill.

6. Business meeting.

Division of Forest-Wildlife Management

Tuesday afternoon, November 15

Lansing H. Parker, Chairman
James B. Gilligan, Vice Chairman
Howard A. Miller, Secretary

1. "Coordination — The Practical Approach to Better Forest Game Habitat." Howard A. Miller and R. H. Millar, U. S. Forest Service, Atlanta, Ga., and Washington, D. C.

2. "Aerial Application of 2,4-D to Improve the Browse Supply for Deer." L. W. Krefting, Bureau of Sport Fisheries and Wildlife, St. Papl, Minn.; H. L. Hansen, School of Forestry, University of Minnesota, St. Paul; and R. W. Hunt, Bureau of Sport Fisheries and Wildlife, Rochert, Minn.

3. "Fishing-for-Fun Program on Trout Streams in Great Smoky Mountains National Park." Robert Lennon, U. S. Bureau of Sport Fisheries and Wildlife, La Crosse, Wis.

4. "Forest Wildlife Relationships in Denmark." Ralph T. King, State University College of Forestry at Syracuse University, Syracuse, N. Y.

5. Business meeting and election of officers.

Division of Forest Management

Wednesday morning, November 16

Thomas B. Glazebrook, Chairman
Frank D. Irving, Jr., Vice Chairman
Wm. J. Bridges, Jr., Secretary
W. T. Doolittle, Program Chairman
Symposium: "Progress in the Technology and Knowledge of Forest Fire

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Merle S. Lowden, Moderator

1. "The New Air Arm in Forest Fire Suppression." William A. Peterson, U. S. Forest Service, Quincy, Calif.

2. "What Progress Are We Making in Protecting Small Forest Holdings from Fire." Clinton H. Coulter, Florida Forest Service, Tallahassee, Fla.

3. "Progress in the Development of a Unified Forest Fire Danger Rating System." John J. Keetch, U. S. Forest Service, Asheville, N. C.

4. "Forest Fire Research and the Need for Fire Laboratories." J. S. Barrows, U. S. Forest Service, Missoula, Mont., and Charles C. Buck, U. S. Forest Service, Washington, D. C.

5. "Better Quantitative Observations of Atmospheric Phenomena in Going Fires." Vincent J. Schaefer, Research Consultant, Schenectady, N. Y.

Wednesday afternoon, November 16

1. Report of nominating committee and election of officers for 1961.

Theme: "Forest Management Moves Ahead."

2. "Trends in Forest Management Practices on Private Forest Lands in Maryland." Adna R. Bond, Maryland Department of Forests and Parks, Annapolis, Md.

3. "Management Control in Uneven-Aged Eastern Forests." Glenn E. Smith, U. S. Forest Service, Upper Darby, Pa.

Comments. Ronald A. Bartoo, School of Forestry, Pennsylvania State University, University Park, Pa.

4. "Multiple-Use Management on National Forest Lands." Lowell O. Woods, U. S. Forest Service, Albuquerque, N. Mex.

5. "Antibiotics Look Good in the Fight to Save Western White Pine from Blister Rust." Homer J. Hartman, U. S. Forest Service, Missoula, Mont.

Discussion. Glenn R. Allison, U. S. Forest Service, Upper Darby, Pa.; William Klomparens, The Upjohn Company, Kalamazoo, Mich.; and Jack Ziffer, Pabst Brewing Company, Milwaukee, Wis.

Division of Range Management

Wednesday morning, November 16

Lowell K. Halls, Chairman

Chas. Terwilliger, Jr., Vice Chairman

1. "Recovery of Herbaceous and Shrubby Vegetation Seven Years After Logging." George A. Garrison, Pacific Northwest Forest and Range Experiment Station, LaGrande, Ore.

2. "The Alpine: Its Place in Multiple-Use Management." Clinton H. Wasser, College of Forestry and Range Management, Colorado State University, Fort Collins, Colo.

3. "Better Use of Native Forage in Southern Forests." Robert E. Williams, Soil Conservation Service, Athens, Ga.

4. "Conversion from Brush to Grass for Multiple Land Use." Merton J. Reed and Jay R. Bentley, Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.

5. "Livestock-Game Use in White Pine Forests of Idaho." Edwin W. Tisdale, Forest, Wildlife, and Range Experiment Station, University of Idaho, Moscow, Idaho.

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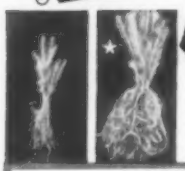

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Division of Education

Wednesday morning, November 16

William C. Bramble, Chairman
John Carow, Vice Chairman
Allen W. Goodspeed, Secretary
Panel Discussion: "The Proper Role of Extension and Adult Education in Forestry Education"
John Gray, Moderator

1. "State-Level Forestry Responsibilities of a Land-Grant College Extension Service." C. B. Ratchford, Missouri Agricultural Extension Service, Columbia, Mo.
Discussion.

2. "Extension as a Major Phase of a Forestry School Program." R. J. Preston, School of Forestry, North Carolina State College, Raleigh, N. C.
Discussion.

3. "Meeting the Continuing Education Needs of a Forestry School's Executive and Professional Clientele." John W. Barrett, College of Forestry, Syracuse, N. Y.
Discussion.

4. Report of Safety Committee and election of officers.

5. "Selection of Personnel for the U. S. Forest Service." K. M. Daniels, U. S. Forest Service, Washington, D. C.
Discussion.

Division of Watershed Management

Wednesday afternoon, November 16

Jack S. Rothacher, Chairman
Paul J. Zinke, Vice Chairman
Percy B. Rowe, Secretary
Symposium: "Watershed Management's Expanding Action Program."
Harold G. Wilm, Moderator

1. "Pilot Test Watershed Project on the Arizona National Forests." Fred H. Kennedy, U. S. Forest Service, Albuquerque, N. Mex.

2. "Logging Small Watersheds in Western Pennsylvania." James F. Heagy, American Waterworks Service Company, Inc., Philadelphia, Pa.

3. "Forest Plantation Development Influences Streamflow." L. W. Hill, Central States Forest Experiment Station, Columbus, Ohio.

4. "Evaluation of the Hydrologic Effect of a Watershed Plantation." Lloyd L. Harrold, Agricultural Research Service, Coshocton, Ohio.

5. "Some Watershed Activities and Results in the Tennessee Valley." K. J. Seigworth, Division of Forestry Relations, Tennessee Valley Authority, Norris, Tenn.

6. "Watershed Management in Action in the Pacific Southwest." W. S. Hopkins, Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.

Note: No business meeting will be held at the annual meeting unless specifically requested (by at least 10 members). A nominating committee will be named to choose the incoming Secretary. Other offices are filled by automatic advancement of the 1960 Vice Chairman and Secretary.

The Society Dinner

Wednesday evening, November 16

Tom Gill, Toastmaster

1. Presentation of the Sir William Schlich memorial medal, by President Charles A. Connaughton.

2. Presentation of the Gifford Pinchot medal, by President Connaughton.

3. Presentation of the award for achievement in biological research, by President Connaughton.

4. Address. Howard A. Meyerhoff,

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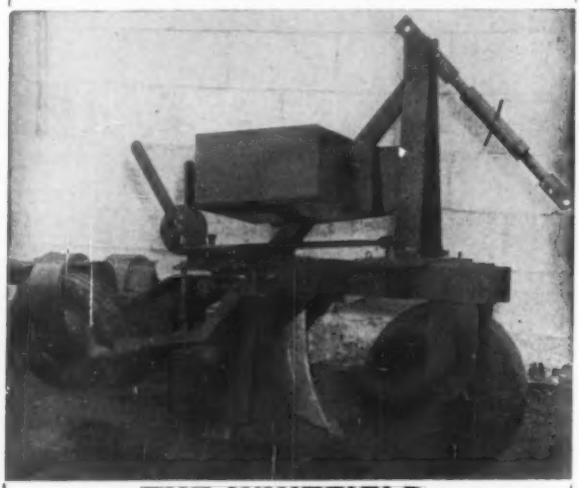

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5. The Howard University Choir.
6. Dancing, 10 p.m. to 1 a.m.

Hotel Reservations

Those planning to attend the meeting are advised to arrive in Washington on Sunday, November 13. The first general session will start at 9:30 a.m., Monday, in the Sheraton-Park Hotel. All scheduled sessions will be held in this hotel.

The Sheraton-Park is on Woodley Road, just west of Connecticut Avenue. The address is 2660 Connecticut Avenue N. W., Washington 8, D. C. The hotel has 1,200 rooms.

There will be no central housing bureau for this meeting. Members should make their own room reservations direct with the hotels of their choice. To enable the hotels to confirm requests, reservations should be received by them not later than October 28. Early reservations are urged.

In all cases, reservation requests should state that the reservation is for the meeting of the Society of American Foresters.

Additional cooperating hotels are listed below, with their rates.

A map of the D. C. Transit System showing streetcar and bus routes will be found on pages 4 and 5 of the Washington Yellow Pages telephone directory.

Those wishing additional information about hotels and their rates can obtain a complete list from the Washington Convention and Visitors Bureau, 1616 K Street N. W., Washington 6, D. C. Or they can consult the current *Hotel Red Book*, copies of which are available in most hotel lobbies and public libraries.

Hotels and Rates

All rates quoted are for rooms with bath. These are daily rates, subject to the District of Columbia sales tax. If the rate category requested is unavailable, rooms in the next highest category will be assigned.

Sheraton-Park Hotel, 2660 Connecticut Avenue N. W., Washington 8, D. C. Single occupancy, economy, $9.85 to $11.35; standard, $12.85 to $13.85; luxury, $15 to $16.50. Twin-bed rooms, economy, $12.85 to $13.85; standard, $15 to $16.50; luxury, $18 to $20. Parlor and one bedroom suites, $19 to $45. Parlor and two bedroom suites, $55 to $65.

Ambassador Hotel, 14th and K Streets, N. W., Washington 5, D. C. Single occupancy, $9 to $10.50. Double-bed rooms, $12 and $13. Twin-bed rooms, $15 to $16.50.

Burlington Hotel, Vermont Avenue at Thomas Circle, Washington 5, D. C. Single occupancy, $8.95 to $10.95. Double-bed rooms and twin-bed rooms, $13.95 to $15.95. Suites, single occupancy, $12.50; double occupancy, $17.75.

Fairfax Hotel, 2100 Massachusetts Avenue N. W., Washington 8, D. C. Twin-bed rooms, $14. Family suites (two connecting twin-bed rooms for four persons), $16.

Manger Annapolis Hotel, 12th and H Streets N. W., Washington 5, D. C. Single occupancy, $8.50. Double-bed rooms, $11. Twin-bed rooms, $12.

Manger Hamilton Hotel, 14th and K Streets N. W., Washington 5, D. C. Single occupancy, $9. Double-bed rooms, $12. Twin-bed rooms, $13.50.

Manger Hay-Adams, 16th and H Streets N. W., Washington 6, D. C. Single occupancy, $14, $16, and $18. Double-bed rooms, $18 and $20. Twin-bed rooms, $20 and $22.

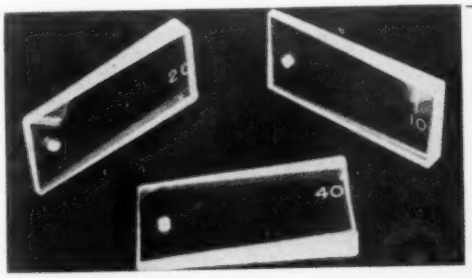
Mayflower Hotel, Connecticut Avenue at DeSales Street, Washington 6, D. C. Single occupancy, $9 to $20.50. Double-bed rooms $15 to $23.50. Twin-bed rooms, $17 to $25.50.

Shoreham Hotel and Motor Inn, Connecticut Avenue at Calvert Street, Washington 8, D. C. (One block from the Sheraton-Park Hotel.) Single occupancy, $13. Twin-bed rooms, $17. Suites, parlor and twin-bed room, $25; parlor and two bedrooms, $42. The motor inn has rooms each equipped with two double beds, $13 singles and $17 doubles.

Statler Hilton Hotel, 16th and K Streets N. W., Washington 13, D. C. Single occupancy, $7 to $12. Double-bed rooms, $9.50 to $15. Twin-bed rooms, $12 to $18.

Washington Hotel, Pennsylvania Avenue at 15th Street N. W., Washington 4, D. C. Single occupancy, $9, $10, $11.50, $12.50. Double-bed rooms and twin-bed rooms, $14.50, $16, $18. Roll-in-beds, $3.

Willard Hotel, Pennsylvania Avenue at 14th Street N. W., Washington 4, D. C. Single occupancy, $8.50 to $14. Double-bed rooms, $13.50 to $19. Twin-bed rooms, $15 to $21.



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Council's Column

Communicating A Forestry Message

One of my previous Council's Column messages dealt with the subject of how well the public knows the forester and the forestry profession. This message is related to the previous one but deals more specifically with communications.

Forestry is defined as an art and a science. It deals with the biologic sciences, the economy, and the engineering. In the area of science the forester must have knowledge of silvics, ecology, soils, dendrology, entomology, pathology, genetics, mathematics, surveys and maps, research and finance.

It is his knowledge of these subjects that gives him the ability to manage land and water which are, after all, the basic resources upon which forestry depends. It is also this knowledge which distinguishes the forester from the nonprofessional forest worker. These are the attributes which enable the forester to make his decisions affecting land and forest management based upon a careful study of all related factors.

Forestry is an art because it deals with the humanities. The well-rounded forester must be able to speak and write in order to communicate his ideas clearly and concisely to extremely variegated groups of people. If he lacks this ability, he should strive to acquire it, and if not satisfied with that effort, seek assistance from those particularly trained in expressing a thought phrased to reach a specific audience. The forester, having mastered the complex sciences of forestry, is best able to judge the technical accuracy of the statements being used to describe a situation just as he appraises the technical application of practices in the woods.

The necessity of communicating to specific audiences is not a new idea to foresters, but it can stand repetition because we meet the problem head-on in whichever direction we move in selling our product.

Take, as an example, the general low level of productivity of forest lands in small ownerships throughout the United States. Finding the method of creating interest among these owners so they will take the action to make their lands fully productive is a real challenge to the forester. Nearly fifty years of effort by foresters and nonprofessionals has not produced completely satisfactory results. The small landowner conferences and several small scale research projects probing the minds of these owners to determine the reasons for adopting, rejecting, or discontinuing practices to develop the forest have shed some light on the subject. Perhaps we need more motivation information and then develop a method of communication to reach the target. This could be a method acceptable and common for application by the profession irrespective of type of employment of foresters.

Many other examples can be cited where communication is vital. In this field, the forester must surely be prepared to wear several hats. A message developed to reach the small ownerships will not be suitable for presentation before women's clubs, or civic clubs, or the schools. Neither does it meet the requirements of the businessmen nor the professional groups. The industry forester needs an entirely different approach to sell his forestry program to top management. The list goes on and on—each one building to the importance of clear and concise communications. Without this, our message can well be rejected regardless of its logic and technical accuracy.

My references to clear and concise communications mean removing mystifying statements about forestry in our presentations which tend to confuse the audience—even to the extent that it does not understand us. We understand our terms but others outside the profession likely do not. This, however, does not mean that professional standards are lowered since the forester requires thorough knowledge of the biologic sciences before he can informatively discuss any phase of forestry including the rudimentary elements.

It is perhaps not good taste to use a personal experience to illustrate a point but since this is the best available to me, I shall use it. It became the job of the Southern Pulpwood Conservation Association to prepare a colored slide presentation describing the coordinated effort of our member pulp and paper companies in developing the southern forest combining this with man's use of paper products. Our consulting public relations agency was given the assignment with these four guidelines—(1) the audience was the civic clubs, (2) the presentation should be between 15-20 minutes, (3) we wanted a new approach, and (4) we provided them with a list of ten key points that had to be established in the presentation. After weeks of con-

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sultation, revisions, and some degree of anxiety concerning the reception of this "new approach," the company foresters making the civic programs were called together by states to be trained in presenting the material. This was the test.

A few were critical, some had reservations, but the majority were enthusiastic after seeing it the first time. The foresters were anticipating another forestry message expressed in standard forester's terms, and this different method of communicating an idea disturbed them. Those who had reservations and some of the critical informed us that they were amazed at the favorable reception of the material by the audience.

I reaffirm a previous statement that the forester must guide his line of communications just as he passes judgment on specific practices in the woods. This suggests that we improve our ability to relate our message to the personal interest in forestry of each specific audience described in terms easily understood by it.

H. J. MALSBERGER

Planning Committee Appointed

At the Council meeting on May 9-10, the members voted to authorize a special Planning Committee to study what the Society's principal goals should be during the decade 1961-1970, and to suggest ways and means by which the goals might be attained.

It is generally agreed that this decade promises to be a momentous period in the history of the Society and the development of the profession. In order that the Society may continue to function in the best interests of the profession and to provide leadership in those phases of its growth where SAF leadership is appropriate and necessary, the Council believes that a long-range study by such a committee could be helpful.

What is needed is not an "action" committee, but rather one to develop ideas and plans. Hence it can be fairly large.

President Connaughton has invited Lee M. James to serve as chairman of the Committee, and he has accepted. His address is Department of Forestry, Michigan State University, East Lansing, Mich.

Other members appointed by President Connaughton are:

John R. Curry, Sr., R.F.D. 1, Box 116, Saranac Lake, N. Y.

Walter Ahearn, 4512 Oakwood Road, Columbia, S. C.

Thomas H. Van Meter, c/o Forest Service, Ogden, Utah.

Leon A. Hargreaves, Jr., P. O. Box 1183, Macon, Ga.

William E. Cooper, Virginia Forests, Inc., 301 East Franklin Street, Richmond 19, Va.

William Pendleton House, R.F.D. Marlboro, Chesham, N. H.

R. Keith Arnold, P. O. Box 245, Berkeley 1, Calif.

Z. W. White, Yale School of For-

SOCIETY OF AMERICAN FORESTERS MEMBERSHIP BY SECTIONS, JUNE 30, 1960

Section	Rank	Total	Junior	Member	Fellow	Affiliate	Associate	Student
1. Alaska	22	95	39	48	1	5	2	...
2. Allegheny	7	719	252	334	4	21	9	99
3. Appalachian	4	955	285	480	6	57	4	123
4. Central Rocky Mountain	18	264	93	153	1	6	2	9
5. Central States	13	400	115	215	1	15	8	46
6. Columbia River	2	1,395	540	675	6	92	17	65
7. Gulf States	3	980	293	458	4	136	21	68
8. Inland Empire	17	270	87	114	3	19	4	43
9. Intermountain	15	303	110	142	1	13	2	35
10. Kentucky-Tennessee	20	250	76	156	...	12	6	...
11. New England	9	644	160	315	8	67	13	81
12. New York	12	414	117	216	8	28	13	32
13. Northern California	6	858	283	450	11	54	20	40
14. Northern Rocky Mountain	14	333	107	140	...	22	5	59
15. Ozark	11	486	147	191	2	90	5	51
16. Puget Sound	8	701	252	290	8	82	18	51
17. Southeastern	1	1,503	549	678	5	68	19	184
18. Southern California	21	118	42	62	4	7	3	...
19. Southwestern	19	255	83	147	1	23	1	...
20. Upper Mississippi Valley	10	531	154	207	5	31	10	124
21. Washington, D. C.	16	285	30	212	11	4	28	...
22. Wisconsin-Michigan	5	877	264	390	2	65	13	143
No Section Affiliation[1]	...	292	78	192	8	9	5	...
Corresponding Members	...	147	...	...	...	...	...	...
Honorary Members	...	18	...	...	...	...	...	...
Total Membership	...	13,093	4,156	6,265	100	926	228	1,253

[1]Includes members in U. S. and foreign countries who have requested that they not be designated as members of any Section.

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OFFICERS of the Northern California Section (*left* to *right*) Edward Sturgeon, secretary; Henry Trobitz, vice chairman; Wesley Spinney, chairman; Samuel Bryan, past chairman; and Paul Casamajor, treasurer. Red Bluff, California, June 3, 1960.

estry, 205 Prospect Street, New Haven 11, Conn.

George R. Staebler, Weyerhaeuser Company, Box 420, Forestry Research Center, Centralia, Wash.

John F. Shanklin, Department of the Interior, Washington 25, D. C.

Richard Vance Miles, Jr., 1014 Myrtlewood Dr., Tuscaloosa, Ala.

The Committee expects to arrange a preliminary conference to adopt a "working plan" at the time of the SAF annual meeting in Washington, D. C., next November 13-16.

Individual members who may have suggestions to contribute to the Committee are invited to write to Chairman Lee M. James.

Northern California Section Holds Spring Meeting

Some 100 members of the Northern California Section met on June 3-4 in Red Bluff, Calif., to hold their annual spring field meeting. Jack R. Schoening, U. S. Plywood Corporation, was general chairman of the event which included an evening banquet and an all-day field trip.

Diamond-National Corporation, host for the field trip, took members on a guided tour over selected areas on their 225,000-acre tree farm. Of particular interest to those assembled was Diamond's thinning program in both second growth and previously logged virgin stands.

Section officers installed at the Red Bluff meeting included Chairman Wesley W. Spinney, U. S. Forest Service, Eureka; Vice-chairman Henry K. Trobitz, Simpson Redwood Company, Arcata; Secretary Edward Sturgeon, Humboldt State College, Arcata; and Treasurer Paul Casamajor, University of California, Berkeley.

Washington Section Officers Announced

The Washington Section's officers for 1960-1961 have been elected as follows:

Chairman—George Vitas, Forest Service, U. S. Department of Agriculture.

Vice chairman—Henry F. Wersching, Bureau of Indian Affairs, Department of the Interior.

Treasurer—Ralph H. Hodges, Jr., National Lumber Manufacturers Association.

Secretary—Gorden G. Marks, Forest Service, U. S. Department of Agriculture.

Ozark Section Meets

One hundred and twenty-five members and guests of the Ozark Section, Society of American Foresters, attended the summer meeting at Salem, Mo., June 2-4, 1960. The three-day meeting combined recreation, five field trips, and the dedication of the state nursery at Licking, Mo., as the "George O. White State Forest Tree Nursery," honoring the retired state forester.

Fifty members in 14 "john-boats" and 5 canoes floated the Current River from Round Springs to Cooley's Ferry. In spite of strong currents, rocks, "chutes," and dead trees, only 7 of the "john-boats" upset—one of them twice. Fishing was good, catching relatively poor, but the trip was very enjoyable. Excellent meals were provided on the river bank.

The five field trips held on June 3 highlighted forest management, game management, research projects, utilization, the "SAF" Natural Area, and multiple use of land as a basic resource. All of the field trips ended at Round Spring State Park where a fish fry followed a social hour.

Dean Stanley G. Fontana, University of Michigan School of Natural Resources, gave the dedicatory address at the nursery program. This formal program was preceded by inspection of the nursery and the Missouri Conservation Commission's Forestry Department Central Repair, Radio, and Sign shops, located at Salem.

The planning for the meeting was a major activity for all of the Section members in Salem, and several from other parts of the state. Nelson Rogers, general program chairman, was

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Continued Accreditation of Oregon State College

The Council of the Society has voted to continue the accredited status of Oregon State College for professional education in forestry. This action was taken on the recommendation of the Society's Committee for the Advancement of Forestry Education (F. H. Kaufert, chairman).

In April the Society participated in an examination of the College, as part of a team of 31 specialists, conducted by the Northwest Association of Secondary and Higher Schools. Ernest Wohletz, dean of the University of Idaho College of Forestry, and Henry Clepper, executive secretary, represented the SAF.

Oregon State College was one of 14 institutions originally accredited by the Society in 1935, and has been on the accredited list ever since.

The evaluation made in April was a routine examination. Neither the accredited status of the College as a whole nor of the forestry curriculum was in question.

Resolution on the Employment of An Assistant Executive Secretary

Whereas the Council of the Society of American Foresters has authorized the employment of an Assistant Executive Secretary; and

Whereas the rapidly increasing importance of the natural resources for which foresters have direct responsibility requires that the forestry profession continue to grow in providing scientifically sound leadership in the development and use of those resources; and

Whereas the Society of American Foresters is recognized as the professional organization and spokesman for foresters; and

Whereas this appointment could substantially affect the professional status of the Society in its relations with other scientific and professional organizations, Congressional committees, the United States Civil Service Commission, and similar groups;

Therefore be it resolved that

1. The Kentucky-Tennessee Section of the Society commends the Council on this important and necessary action;

2. The Kentucky-Tennessee Section believes that the following qualifications should be considered as minimum in selecting a man for this important post:

a. proven leadership ability and stature within the profession;

b. demonstrated ability to deal successfully with individuals, institutions, organizations, and similar groups;

c. ability to serve as a spokesman for the Society;

d. ability to organize and administer an organization of the scope and complexity of the Society of American Foresters;

3. The Section believes that the appointee should be potential executive director material, and not just an administrative assistant;

4. Copies of this resolution be sent to each Council member and officer of the Society of American Foresters, and to the Chairmen of the Sections of the Society.

June 11, 1960

Natural Area Selection Policy

Definition.—Forestry Terminology, issued by the Society of American Foresters, defines a natural area as:

"An area set aside to preserve permanently in unmodified condition a representative unit of the virgin growth of a major forest . . . type primarily for the purposes of science, research, and education. Timber cutting and grazing are prohibited and general public use discouraged."

Problem.—The phrase in this definition "a representative unit of the virgin growth of a major forest type" has been the subject of discussion by the Committee on Natural Areas ever since its formation in February, 1947. The Committee has agreed that it is virtually impossible to find virgin growth areas representing all Society of American Foresters forest type associations. Some recognized types occur only as second growth.

Natural area policy.—At the 1959 annual meeting of the Society in San Francisco, this point received considerable attention from the members of the Division of Silviculture. The Division was advised at that time that the Committee would reconsider this situation during the year. The Committee prepared and submitted to the Section Liaison Officers for Natural Areas a proposal to either change the definition or to issue a policy statement for the guidance of those submitting proposals for new natural areas.

On the basis of our consultation with the liaison officers the Committee will follow these guidelines in its consideration of areas submitted for formal listing:

1. The definition emphasizes *major* forest types. The Committee has constantly indicated the desirability of

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preserving *all* forest types. It will continue to stress the importance of locating and preserving areas carrying any of the recognized SAF forest type associations.

2. The definition specifies *virgin* type associations. Emphasis will continue to be placed on the utmost desirability of locating and preserving *virgin* forest type associations. Through every means at its command the Committee will continue to search for areas carrying *virgin* forest type associations.

3. If representative samples of a given type are lacking from the natural area system, and if it may be demonstrated that true virgin areas cannot be located, then areas which in composition and appearance no longer reflect past disturbance by white man will be favorably considered and listed. The recommendation from the sponsoring agency shall include a statement as to the approximate number of years since man's influence. However, if the area is of old field origin, it will not be favorably considered unless it can be conclusively demonstrated that the area is very likely to represent the only such area in the nation to provide protection for the forest type in question.

JOHN F. SHANKLIN, *Chairman,*
Committee on Natural Areas

SAF Consulting Foresters Directory to be Published

Persons and firms listed in the SAF Consulting Foresters Directory published in the January 1960 JOURNAL OF FORESTRY have been requested by mail to approve, correct, or revise their listings for the new directory to be published in the January 1961 JOURNAL.

Members doing consulting forestry work and whose names have not previously appeared are invited to apply now for listing. They should provide complete information following the form used in the List of Consulting Foresters published in the January 1960 JOURNAL OF FORESTRY. Society membership is a prerequisite for listing. Such members must be in good standing, i.e., have paid their 1960 dues. Consulting firms will be listed if one or more of the partners or employees are members of the Society.

November 1, 1960 is the last date on which listings will be accepted for publication in the January 1961 directory.

Hartwick, Otsego County, N. Y.
June 25, 1960

Editor, JOURNAL OF FORESTRY,
Washington, D. C.

During the fifty years that have "melted away" since I became actively engaged in Federal Forest Administration and a constant reader of the JOURNAL OF FORESTRY, I have never enjoyed the reading of an issue of this periodical more keenly than I did the reading last evening of the June issue, devoted primarily to discussions of our forty-ninth state—incomparable Alaska.

This issue rekindled the fires that warmed my heart when I read the first issue of the very modest *Forestry Quarterly* which was published in October, I believe, of the year 1900. (I cannot check this, for my complete files of the *Quarterly* and the succeeding JOURNAL were presented to Hartwick College six years ago and have since been transferred to Cornell University.) Dr. B. E. Fernow, eminent scholar, distinguished leader in American forestry and an enthusiastic member of his profession, had grave doubts at that time whether a periodical devoted exclusively to forestry would arouse enough interest to justify its continuance. Does it seem possible that forestry was such an infant at the beginning of the twentieth century?

What phenomenal progress forestry has made in threescore years!

The contributions of Heintzleman, Bruce, Lutz, and Helmers are so pertinent, so enlightening, so timely and those of Zumwalt, Robinson, Nelson, and Byers are so informative, so comprehensive, so encouraging that they bring an "old-timer" to his feet with an exclamation of "Bravo!" What a thrill would George P. Marsh, or Franklin B. Hough have gotten from these contributions to a science and a practice for which they sought to arouse an incipient interest!

What an inspiration should the young forester derive from these expositions of a new world to conquer similar to the challenge that the establishment of a forest policy for the continental United States had for those who were just entering the lists in the year 1900! The members of a generation that is now fast "fading away" did not fail in the accomplishment of the task that faced them at the beginning of the century. The rising generation of foresters will not fail in the enormous task of saving the forest resources of Alaska!

I am particularly pleased to note that contributions have been obtained from men representing the Department of the Interior and also private industry, as well as from the Forest Service in the Department of Agriculture. More from the compelling force of circumstances than from personal desire it fell to my lot as a forester in the Interior Department to oppose, on several occasions and

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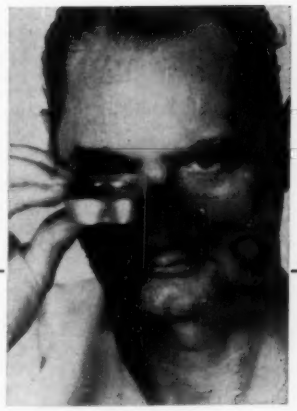

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over a period of thirty years, forest policies favored by some foresters in the Department of Agriculture but never did I fail to recognize and applaud the sincere devotion of the foresters in the Department of Agriculture to the cause of conservation and to view with approbation the success obtained in the administration of the National Forests. Incidentally, I may say that my sympathies are strongly with the members of the National Forest Service in their resistance to recent efforts in another department to effect changes in the legal status of certain lands now in the National Forest which some foresters believe would tend toward the emasculation of the National Forest system. Possibly the foresters in the Department of Agriculture are somewhat unduly concerned as to the purposes of others just as I am sure they were for many years with respect to my activities while I was officially connected with the Department of the Interior. I certainly hope their current anxiety is as unfounded as was their former misunderstanding of the motives which prompted my unalterable opposition to the establishment of coercive federal regulation of private forestry.

I earnestly trust that the professional catholicity exhibited by the JOURNAL OF FORESTRY and by the periodical of the American Forestry Association may prevail in the crucially important project of developing effective conservation policies in Alaska.

Cordially yours,
/s/ J. P. Kinney

Membership Applications and Advancements

Proposals for admission, advancement, and reinstatement received in the Society office during the month of July are listed below.

Action on the eligibility of those proposed for membership as listed below will be taken by the Council as of September 30, 1960.

Communications from the voting members regarding the membership eligibility of these persons should be received in the Society office prior to that date.

Alaska Section

Junior Grade

Galea, J., Forester, USFS, Craig, Alaska (Reinstatement).

Member Grade

Crozer, E. A., Forester, USFS, Sitka, Alaska. Mont. State, BSF, 1956 (Junior 1956).

Allegheny Section

Junior Grade

Collier, J. C., Forester, USFS, Richwood, West Va. Univ. Mich., BSF, 1959.

Keller, W. C., Mgr., Woodland Products, Inc., Downingtown, Pa. (Reinstatement).

Price, C. J., Asst. State Cons., Soil Cons., New Brunswick, N. J. (Reinstatement).

Member Grade

West, J. L., Land Agent, U. S. Steel Corp., Gary, West Va. West Va. Univ., BSF, 1956 (Junior 1956).

Appalachian Section

Member Grade

VanSurdam, J. A., Forester, International Paper Co., Aiken, S. C. State Univ. N. Y., BSF, 1955 (Junior 1956).

Affiliate Grade

Putney, R. T., Consulting Forester, Self-Employed, Manakin, Va.

Central States Section

Junior Grade

Student Eligible for Automatic Advancement

PURDUE UNIVERSITY

Reid, R. G.

Columbia River Section

Student Grade

OREGON STATE COLLEGE

Kennedy, A. R.

Junior Grade

Franks, W. R., Reed Lodge, Ore. State College, Corvallis, Ore., Ore. State, BSF, 1960.

Students Eligible for Automatic Advancement

OREGON STATE COLLEGE

Ames, G. L.
Bussard, J. E.
Carter, M. I.
Jorgensen, Q.
Judge, L. T.
Judson, A.
Oliver, E. K.
Schwietert, W.
Sisson, V. E.
Timberman, C. H.

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Gulf States Section

Junior Grade

Johnson, R. L., Research Forester, Stoneville Research Center, Stoneville, Miss. Purdue Univ., BSF, 1955.

Member Grade

Williamson, B. C., Dist. Forester, T. L. James & Co., Inc., Covington, La. La. Poly. Tech., BSF, 1951 (Junior 1955).

Affiliate Grade

Bell, D. S., Area Forester, D. L. Fair Lbr. Co., Bruce, Miss.
Campbell, D. L., Forester, La. Forestry Comm., Oberlin, La.
Chancellor, G. A., Dist. Forester, East Texas Pulp & Paper Co., Woodville, Texas.

Inland Empire Section

Student Grade

UNIVERSITY OF IDAHO

Brock, C. E.

Affiliate Grade

Laishley, D. W., Forester, Kootenay Forest Products, Ltd., Nelson, B. C., Canada.

Intermountain Section

Junior Grade

Student Eligible for Automatic Advancement

UTAH STATE UNIVERSITY

Lewis, W. E.

New York Section

Junior Grade

Biesterfeldt, R. C., 8452 85th Ave., Woodhaven, N. Y. Pa. State, BSF, 1960.

Northern California Section

Junior Grade

Students Eligible for Automatic Advancement

UNIVERSITY OF CALIFORNIA

Benedict, R. M. Hooper, J. F.
Ceragioli, J. S. Unsoeld, G. S.

Ozark Section

Junior Grade

Ray, R. D., Forester, USFS, Mount Ida, Ark. (Affiliate 1956).

Member Grade

Harris, R. L., Tbr. Mgmt. Asst., USFS, Russellville, Ark. Mich. State, BSF, 1951 (Junior 1951).
True, M. G., Asst. Ranger, USFS, Houston, Mo. Iowa State, BSF, 1953, N. C. State, MF, 1960 (Junior 1953).
White, M. C., Forester, International Paper Co., Sheridan, Ark. Yale, MF, 1955 (Junior 1955).

Affiliate Grade

Carmichael, D. H., Forester, USFS, Jasper, Ark.
Crossett, R. L., Forester, USFS, Mt. Ida, Ark.
Efird, M. O. Forester, USFS, Ozark, Ark.
Ragan, R. N., 202 So. Jackson St., DeWitt, Ark.
Triplett, W. H., Lewisville, Ark.
Trude, J. F., 2331 Fearing Ave., Camden, Ark.
Wood, B. R., USFS, Waldren, Ark.

Puget Sound Section

Student Grade

UNIVERSITY OF WASHINGTON

Callahan, B. T. Nichols, F. R

Junior Grade

Carruth, T. J., Forester, USFS, Cle Elum, Wash. La. Poly. Tech., BSF, 1959.

Students Eligible for Automatic Advancement

UNIVERSITY OF WASHINGTON

Cain, A. B. Merrill, S. B.
Ensley, B. J. Mohlman, D. T.
Freese, R. G. Moore, L. C.
Heimbigner, C. L. Reed, J. E.

Southeastern Section

Junior Grade

Jones, J. S., Forest Supv., St. Regis Paper Co., Lumpkin, Ga. Auburn Univ., BSF, 1950.
Williams, L. M., Area Forester, Buckeye Cellulose Corp., Foley, Fla. Univ. Fla., BSF, 1940.

Students Eligible for Automatic Advancement

AUBURN UNIVERSITY

Dukes, J. A.

UNIVERSITY OF FLORIDA

Wetzel, A. G.

UNIVERSITY OF GEORGIA

Brown, G. K.

Member Grade

Dougherty, D. A., Unit Forester, International Paper Co., Marianna, Fla. (Reinstatement).
Rogers, C. J., Research Forester, St. Regis Paper Co., Jacksonville, Fla.

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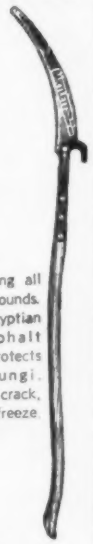

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Mich. State, BSF, 1951 (Junior 1956).
Worst, R. H., Research Forester, Brunswick Pulp & Paper Co., Brunswick, Ga. Duke Univ., MF, 1955 (Junior 1955).

Affiliate Grade

Swendsen, B. M., Farm Forester, Fla. Forest Service, Lakeland, Fla.

Southern California Section

Affiliate Grade

Porter, D. K., Fire Prevention Officer, USFS, Pasadena, Calif.

Wisconsin-Michigan Section

Student Grade

MICHIGAN STATE UNIVERSITY

Gutsch, R. E. Morgan, E. J.

Junior Grade

Berbee, J. G., Asst. Prof., Univ. of Wisconsin, Madison, Wis. (Reinstatement).
Ottoson, D. E., Work Unit Cons., USDA, Newberry, Mich. Mich. College Mining & Tech., BSF, 1955.

Students Eligible for Automatic Advancement

MICHIGAN STATE UNIVERSITY

Beavers, J. R. Sellinger, J. R.
Taylor, W. E.

No Section

Corresponding Grade

Bose, A., Deputy Conservator of Forests, Government of West Bengal, Calcutta, India.
Tigre, C. B., Chief, D.N.O.C.S., Fortaleva Ceara, Brazil, South America.

Forestry News

New Lab For Lake City Forest Researchers

The dedication of the new Lake City Research Center office and laboratory of the Southeastern Forest Experiment Station, near Olustee, Fla., was held July 27. The building, which provides working space for U. S. Forest Service researchers, is located on the Olustee Experimental Forest, 12 miles east of Lake City, Fla.

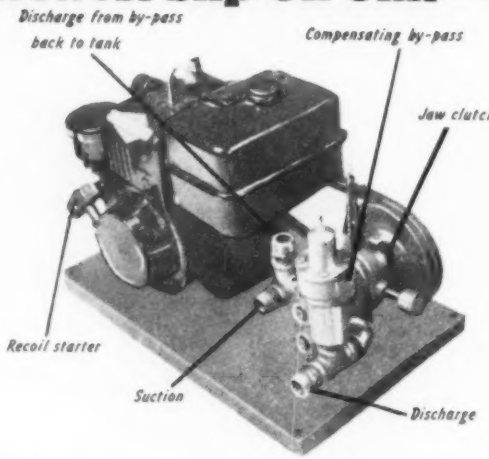
The recently completed structure contains 8,700 square feet of floor space divided about equally into offices and laboratories. According to Karl F. Wenger, officer in charge, the new facilities in combination with the 3,000-acre Olustee Experimental Forest will facilitate study of forestry problems from the basic physiological and soil factors affecting tree growth to the testing of practical forestry methods under field conditions. Equipment is provided for research in tree physiology, genetics, soils, insects, and diseases with respect to survival, growth, seed production, and gum yield of southern timber trees.

NEW LABORATORY at Lake City (Fla.) Research Center.

The Lake City Center, one of the largest forest research centers in the U. S., is visited each year by hundreds of American foresters, as well as foreign biologists and tree experts.

The Center headquarters was formerly located in the Post Office building at Lake City. In its new quarters, it will continue to serve the longleaf-slash pine area of Florida and south Georgia. Research teams linked with the Center also work in south Florida at Fort Myers, and in Georgia at Tifton.

PANAMA'S Newest Slip-On Unit - - - Model 200



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HATTIESBURG P O BOX 689 MISSISSIPPI

AUSTIN L. LENTZ, forestry specialist of the Cooperative Extension Service of Rutgers University, points out some leaf characteristics to two 4-H Club members who have forestry projects, David Griffin and Claudia Diem. The two young persons have tied for first place in this year's state 4-H tree identification contest at Rutgers. In New Jersey, many suburban young people are developing a greater appreciation of trees and wider knowledge of them through the 4-H forestry project.

New Forest Industries Combined Magazine Issued

The first combined edition of *American Tree Farmer & Forestry Digest* has been published.

The enlarged magazine is a combination of the quarterly *American Tree Farmer* and the monthly *Forestry Digest* and is published monthly by American Forest Products Industries, Inc., 1816 N Street, N.W., Washington 6, D. C.

A New Society To Promote Wood Utilization

Scientists from nine countries (Belgium, France, Germany, Great Britain, Italy, Norway, Netherlands, Sweden, Switzerland) have launched a new international body to promote the advancement of knowledge and the more efficient utilization of wood and wood products. The initiating meeting of the International Wood Research Society took place in Paris at the Centre Technique du Bois on May 27-28 under the auspices of the Food and Agriculture Organization (FAO).

Dr. E. Glesinger, director of FAO's Forestry and Forest Products Division, who represented FAO at the Paris meeting, pointed out that "the new organization is a non-governmental association, composed of individuals as well as private enterprises or governmental agencies working in the fields of research, education and the technical aspects of wood processing and utilization."

Dr. B. Thunell, Sweden, was named president and Prof. J. Campredon, France, and Dr. L. J. Markwardt, U.S.A., vice presidents of the new Society.

The Society's purpose, Dr. Thunell stated in Paris, was to be fulfilled mainly through the exchange of information and ideas, by sponsoring meetings for the presentation of scientific papers, and by promoting cooperation among individuals, private and governmental agencies, and kindred national or regional organizations concerned with the utilization of wood and wood products.

The Paris meeting was devoted to the adoption of a constitution and a set of bylaws for the establishment of the organization, and to the election of an executive committee.

New Hampshire Timberland Owners' Association 50th Anniversary

The fiftieth anniversary of the New Hampshire Timberland Owners' Association was observed at a meeting in Jefferson, N. H., on June 29. Some

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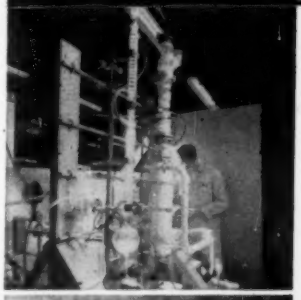

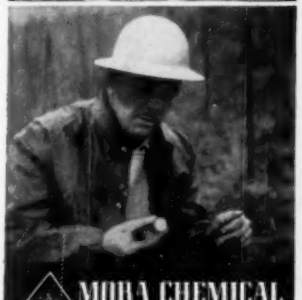

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C. B. MARLIN

200 members and guests were in attendance.

C. S. Herr of Berlin, N. H., president of the Association, presided. Mr. Herr is vice-president of the Brown Company in charge of woods operations.

Featured on the program was Edgar C. Hirst who wrote an account of the formative years of the organization. A graduate of Yale School of Forestry, Mr. Hirst was New Hampshire's first state forester, and later became prominent in banking.

Stewart H. Holbrook, nationally famous author and a native of New Hampshire, spoke about the early history of the forest products industry. He is the author of the well-known book *Holy Old Mackinaw*.

The Timberland Owners' Association was instrumental in establishing New Hampshire's forest fire control organization. It provided funds for building fire lookout stations and for other essential protection services.

Copies of Mr. Hirst's historical sketch may be obtained from Mr. Herr.

Public

Marlin Reappointed Mississippi State Forester

C. B. Marlin was reappointed to the position of state forester by the Mississippi Forestry Commission at its regular monthly meeting on July 6. He has served at that position since 1956.

A native of Mississippi, Marlin graduated from Mississippi State University with special honors in 1943 with a degree in agricultural economics. He served during World War II in the United States and overseas with the First Infantry Division and was seriously wounded in action in the Hurtzgen Forest near Aachen, Germany in 1944.

Upon release from military service, Marlin entered Duke University and graduated with a Master Degree in forestry with the top academic record in his class.

He was then employed by Mississippi State University where he taught forestry and conducted research.

In 1951 Marlin was employed by the Mississippi Forestry Commission as management forester. He later served as assistant forest management director and forest management director before his appointment as state forester by the Forestry Commission in 1956.

He is currently chairman of the Southern Group of State Foresters; vice-chairman of the State Agricultural Coordinating Council; a number of the National and Southern Cooperative Forest Fire Prevention program; board of directors, Mississippi Forestry Association; State Soil Conservation Committee; and Forestry Development Board of Trustees.

New Head of Central States Forest Experiment Station

Richard D. Lane of the Washington, D. C., office of the Forest Service, has been named director of the Central States Forest Experiment Station, Columbus, Ohio. He succeeds William G. McGinnies, director since 1953, who retired July 31, after 30 years of government service.

RICHARD D. LANE

Mr. Lane worked at the Central States Station for 14 years before transferring to the Forest Service's Northeastern Forest Experiment Station at Upper Darby, Pa. He will be responsible for Forest Service research in Illinois, Indiana, Iowa, Kentucky, Ohio, and Missouri.

Born in Kansas City, Mo., Mr. Lane received his B.S. and M.S. degrees in forestry from Iowa State College in 1941 and 1942. He was on the Timber Production War Project during World

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War II in the Central States area. He participated in Forest Service research in Missouri, Illinois, Indiana, Iowa, and Ohio before transferring to Upper Darby in 1956. He is at present assistant director of forest management research in Washington.

R. W. Appleby Returns to NW Region

Reassignment of Robert W. Appleby from the Forest Service Regional office in Milwaukee, Wis., to the regional office in Portland, Ore., has been announced by J. Herbert Stone, regional forester of the Pacific Northwest Region.

Appleby will do sales administration in the Division of Timber Management.

A native of Oregon, Appleby entered the Forest Service as a seasonal employee in 1935 on the Fremont National Forest. Since then he has worked also in various capacities on the Rogue River, Siuslaw, and Willamette National Forests. He was in the supervisor's office of the Willamette National Forest, Eugene, Ore., when transferred to Wisconsin in 1957.

Appleby is a 1940 forestry graduate of Oregon State College.

NEAL M. RAHM

Rahm, Harrison To New Posts

Neal M. Rahm, assistant regional forester in charge of Recreation, Lands and Watershed Management in the Denver Regional Office of the U. S. Forest Service, has been promoted and transferred to the Washington, D. C., office of the Service.

Rahm will head a new Branch of Multiple Use Management and Coordination.

Regional Forester Donald E. Clark announced that Rahm's replacement in Denver will be Henry A. Harrison, who will transfer from the chief forester's office in Washington, where he has served as assistant to the head of the Recreation and Lands Division.

A graduate of the University of California School of Forestry, Rahm has 23 years' experience with the Forest Service. He has served in his Denver position since 1957 when he transferred to Colorado from the Modoc National Forest in California.

After graduating from the University of Washington School of Forestry, Harrison entered the Forest Service in 1935. Prior to transferring to Washington in 1957, he served in various technical and administrative capacities on a number of National Forests in Washington and Oregon. During World War II he served as a naval officer in the Pacific.

Undertakes Lodgepole Studies

David Tackle, research forester, Intermountain Forest and Range Experiment Station, U. S. Forest Service, Ogden, Utah, has been named to direct a new research project in lodgepole pine at Bozeman, Mont.

Tackle has been at the Missoula Research Center since October, 1954, conducting research on the management and timber potentialities of various tree species. He will be stationed on Montana State College's campus where he will direct studies, in cooperation with the College, on various aspects of lodgepole pine management and utilization. He received undergraduate and graduate training in forestry at the University of California, and during the World War II served as a bomber pilot with the Army Air Force.

Before joining Intermountain Station in 1951, Tackle was at the Pacific Southwest Forest and Range Experiment Station in Berkeley, Calif.

Glazebrook Named To New Post

Thomas B. Glazebrook has been promoted to assistant chief of the Timber Management Division in the Regional Office of the U. S. Forest Service, Portland, Ore., according to Regional Forester J. Herbert Stone.

Glazebrook formerly headed the timber management appraisal section. He succeeds Russell P. McRorey, who recently was named assistant regional forester and chief of the new Division of Lands.

Glazebrook was transferred to Portland as logging engineer in 1959 from the Washington, D. C., office of the Forest Service. He began his USFS career in 1939 as a seasonal employee on the Clearwater National

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Forest in Idaho. He resigned in 1942 to enlist in the Corps of Engineers as a private, and served in Alaska, Germany, and the Philippines. He was separated as a lieutenant in December, 1945, and accepted appointment as junior forester on the Eldorado National Forest in California in 1946.

He worked in various capacities on California forests until transfer to Washington, D. C., in 1957.

Forest Inventory of Tennessee River Watershed

The Tennessee Valley Authority has started a forest inventory of the entire Tennessee River watershed. According to Richard Kilbourne, director of the Division of Forestry Relations, five foresters have been assigned to the project. The purpose of the survey is to measure the timber resource of the Valley and determine what has happened to it since the last survey was made in 1950.

The inventory involves collecting data on about 300 fifth-acre forest plots and about the same number of nonforest plots. The survey will be coordinated with a U. S. Forest Service forest inventory of the State of Tennessee, now in progress.

Two previous estimates of the forest resource of the Valley have been made, Mr. Kilbourne said—one in 1940 and the other in 1950.

Siskiyou Supervisor Retires

The retirement of Herschel C. Obye as forest supervisor of the Siskiyou National Forest, Ore., has been announced by Regional Forester J. Herbert Stone. Obye, a veteran of 34 years with the Forest Service, has been supervisor at Grants Pass since 1941.

He is a native of Oregon and graduated from Oregon State College in 1926 with a Bachelor of Science degree in forestry. His Forest Service career began in 1926 with a probational appointment as forest ranger on the Crater National Forest, now the Rogue River National Forest. He has served in numerous capacities in the Northwest since that time.

Supervisor Ellis Retires From Eldorado NF

Guerdon Ellis started his U. S. Forest Service career on the Klamath National Forest in 1926. He advanced rapidly with assignments on the Stanislaus, Santa Barbara (now Los Padres), and Angeles National Forests. He became supervisor of the Cleveland National Forest in 1935.

Ellis has served as supervisor on four national forests in the California Region. In addition to the Cleveland, he has been supervisor on the Trinity, Tahoe, and Eldorado National Forests, Placerville, from which he retired in July.

His longest tour of duty was on the Tahoe National Forest at Nevada City where he was located for 14 years. He has been headquartered at Placerville since 1954.

Ellis holds a B.S. degree in forestry from the University of California.

Succeeding Ellis in the Placerville post is Joseph V. Flynn, a staff officer on the Sequoia National Forest at Porterville. Flynn has been with the Forest Service for 22 years with the exception of four years of military duty. His Forest Service assignments have covered duty on three national forests in the California Region, one of which is the Eldorado where he received his first assignment.

He has a Bachelor of Science degree in Forestry from the Oregon State College.

Private & Industrial

Industrial Forest Economist To FAO Post

Nicholas Muhlenberg, forest economist in Crown Zellerbach Corporation's Portland, Ore., land and tax department, has resigned to accept an appointment as forestry officer with the Timber Section, Forest Economics Branch, Forestry and Forest Products Division of the United Nation's Food and Agricultural Organization's European headquarters in Geneva, Switzerland.

Muhlenberg studied at the University of Pennsylvania while a cadet in the Navy V-12 program. He holds B.S. and M.F. degrees in forestry from the University of Michigan. In 1949 he was attached to the United Nation's FAO timber section in Geneva and studied at the Ecole National des Eaux et Forets at Nancy, France. Later he won a Fulbright scholarship and attended Victoria University College, Wellington, New Zealand.

He was employed by Crown Zellerbach in 1954 and served on the Clatsop, Ore., Tree Farm forestry staff until 1956. In 1956-1957 he took an M.A. degree in economics from Yale University and received his Ph.D. degree in forestry from that school in 1959. Since 1957 he has been employed in Crown Zellerbach's land and tax department.

In his new position Muhlenberg will develop market information and analyze current economic developments on the European forest products scene.

Washington Representative of Lumberman's Association Dies, Successor Announced

Cecil A. Luce, Washington, D. C., manager for the West Coast Lumbermen's Association since 1948, died suddenly June 16 of a heart attack. Mr. Luce was a recognized authority in technical lumber problems and grew up in the sawmill business of the Inland Empire. He spent 25 years in the western pine industry and was for five years the Washington, D. C., manager for the Western Pine Association immediately before joining the West Coast Lumbermen's Association.

Mr. Luce will be succeeded by Edwin O. Thompson, a supervisor of the West Coast Lumber Inspection Bureau since 1953.

Northeasterners Will Discuss "Forestry Industry Opportunities In Rural Development"

The annual fall conference of the Utilization Division of the Northeastern Loggers Association, Inc., will be held at Harrisburg, Pa., Nov. 21-22, 1960, according to an announcement by Fred C. Simmons of the Northeastern Forest Experiment Station, Upper Darby, Pa., Chairman of the Division. Co-sponsors of the conference will be the Pennsylvania Departments of Commerce, and of Forests and Waters.

The object of the conference will be to point out specific opportunities for new or expanded forest industries in the Northeast, which are discussed in a general way in the new U. S. Department of Agriculture Information Bulletin No. 222, *Forest Industry Opportunities in Rural Development.*

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Special invitations to attend are being sent to representatives of the many regional and local industrial development organizations in the 12 northeastern states. Members of the Loggers Association, and any others who are interested, are also invited to attend. Registration blanks and further information can be secured from Frank Schrey III, Forest Utilization Adviser, Pennsylvania Department of Forests and Waters, Harrisburg, who is in charge of local arrangements.

Schools

McGinnies Receives UA Appointment

Dr. William G. McGinnies has been appointed coordinator of the University of Arizona's Arid Lands Project and director of the UA Laboratory of Tree-Ring Research. His appointment by the Board of Regents of the Universities and State College of Arizona was effective August 1.

Since 1954 Dr. McGinnies has been director of the Central States Forest Experiment Station at Columbus, Ohio. He is an alumnus of the University of Arizona and received the Doctor of Philosophy degree in botany, with a major in ecology, from the University of Chicago in 1932. In April, 1960, the University of Arizona awarded him its 75th Anniversary Medallion of Merit.

Born in Colorado, Dr. McGinnies has had extensive experience in range and forestry work in western states.

He was director of the Rocky Mountain Forest and Range Experiment Station in Fort Collins, Colo., from 1944 to 1953. He went to Columbus, Ohio, in January, 1954 as director of the Central States Forest Experiment Station.

Dr. McGinnies served as consultant for the Arid Zone Committee of UNESCO in 1952-1953 and prepared publications in arid zone ecology. He is at present arid zone consultant for the UN Food and Agriculture Organization.

The University of Arizona's Arid Lands Program, which Dr. McGinnies will serve as coordinator, received a grant from the Rockefeller Foundation in 1958 for partial support of three years of interdisciplinary research. The U. S. Geological Survey has also been an active cooperator in the program. University departments directly concerned in the present study of man's utilization of arid lands are Archaeology, Botany, Physics, Geochronology, Geology, Zoology, and the Institute of Atmospheric Physics. Several other university departments have been involved through the programs of these groups.

New York College Librarian Appointed

Terence J. Hoverter was appointed librarian in charge of The Franklin F. Moon Memorial Library of the State University College of Forestry at Syracuse University and a member of the faculty, as associate professor, effective in July 1960.

Professor Hoverter who comes to Syracuse from the State University of New York Maritime College at Fort Schuyler, Bronx, N. Y., becomes the fifth librarian to serve the College of Forestry during its 49-year history. He is the first male ever to hold the position.

Professor Hoverter succeeds Mrs. E. Lee (nee Martha Meelig) Pindle, who retired early this year after a 33-year career at the College of Forestry.

Professor Hoverter will be the head of the institution's staff of professional librarians and will manage what is considered to be the country's largest, separate collection of forestry literature in an institution of higher learning—more than 90,000 catalogued items. Included are close to 25,000 books, over 65,000 pamphlets, booklets, and other publications, plus approximately 400 periodicals.

Professor Hoverter graduated from Fordham University in 1937 with a Bachelor of Arts degree, majoring in history and education. In 1939, he earned a Bachelor of Science degree in library science from the School of Library Service of Columbia University. He specialized in college and university library administration.

In 1954, he earned a Master of Arts degree in American history from Fordham University. At the present

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time, he is a candidate at Fordham University for a Doctor of Philosophy degree in American history.

Wood Expert Concludes Lecture Series

H. E. Dadswell, assistant chief of the Division of Forest Products, Commonwealth Scientific and Industrial Research Organization of South Melbourne, Australia, gave a series of eleven lectures on tree-growth wood property interrelationship during July and August at the School of Forestry, North Carolina State College.

The lectures were a part of a program of a Forest Biology Special Field Institute which was made possible through a grant from the National Science Foundation and which extended over a four-week period.

Dr. Dadswell is one of eight noted scientists who served as principal lecturers at the Institute which laid stress on phases of biometry, ecology, entomology, genetics, growth-wood property interrelations, pathology, physiology, and soils. He is internationally known for his researches on wood property and tree growth relationships.

Cites Three Universities For Historical Collections

The Forest History Society has cited Harvard, Missouri, and Portland Universities for collections of historical materials on forest history which are preserved in their libraries.

B. L. Orell, president of the Society, presented the citations at the annual dinner meeting of the Society in the Rainier Club of Seattle in June. Jacob Kalina, a 1910 graduate of the University of Missouri, accepted the award on behalf of his alma mater's Western Historical Manuscripts Collection. Dr. Austin Grimshaw, dean of the School of Business Administration of the University of Washington, accepted the award for the Baker Library of the Harvard Graduate School of Business Administration. Carl Miller, director of the University of Portland Foundation, accepted the award for the Buckley Memorial Collections of the University of Portland library.

Also announced at the meeting was the election of one Fellow of the Society. Posthumous recognition was made of Ovid McOuat Butler of Washington, D. C., for "his outstanding leadership in the field of North American forestry and conservation, and for his many contributions to the collecting, preserving, writing and publishing of forest history." George L. Drake of Shelton, Washington, a long-time friend of Mr. Butler, received the award on behalf of the Butler family.

The directors of the Society, meeting in annual session, voted approval of an expanded program of collecting, publishing, research, and oral history interviewing for the coming year. Officers elected were: Bernard L. Orell, president; Paul H. Giddens, vice president; Elwood R. Maunder, secretary and executive director; Clarence G. Frame, treasurer; Peggy Fastner, assistant secretary; Charles J. McGough, assistant treasurer.

Londoner Appointed To Louisiana State

Peter J. Fogg has been appointed instructor in forestry (research) at Louisiana State University. A native of London, England, Fogg holds the B.Sc. degree from the University of Wales.

First Colman Fellowship Awarded

Leonard F. DeBano, predoctoral student in the University of California's School of Forestry at Berkeley, has been awarded the first Edward A. Colman Memorial Fellowship in watershed management.

In announcing the award, UC Forestry Dean Henry J. Vaux said the $1,800 Fellowship will enable DeBano to devote full time in the academic year 1960-1961 to his studies for the Ph.D. in soil science.

The Fellowship is endowed by a fund established by friends and colleagues of Dr. Edward A. Colman, pioneering scientist in the field of watershed management and a graduate of the University of California who died in 1956. At the time of his death, he was chief of the Division of Watershed Management in the U. S. Forest Service's Pacific Southwest Forest and Range Experiment Station.

The fund now totals approximately $32,000, the income from which is sufficient for a Fellowship award only every other year. Contributions will continue to be accepted with the purpose of eventually making an annual award.

Graduate Fellowship Awarded By Wood Conversion Company

George M. Blake, a graduate student at the University of Minnesota School of Forestry, has been awarded the Wood Conversion Foundation Graduate Research Fellowship for 1960-1961. A native of California, he was graduated from the University of Idaho School of Forestry in 1957.

The specific objective of the research carried on by Mr. Blake will be to develop some of the basic principles of aspen genetics needed for a better understanding of how heredity and environment influence the yield and quality of aspen in northeastern Minnesota. He will study for his Ph.D. under the direction of Dr. Scott S. Pauley.

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National Science Foundation Grant to Oregon Research Center

Study of reasons why Douglas-fir is hard to establish on south slopes and other troublesome areas in western Oregon will be speeded by a grant of $7,200 from the National Science Foundation in Washington, according to Dale Bever, director of research on forest lands at the Oregon Forest Research Center in Corvallis.

Work will be done cooperatively under direction of Dr. Ernest Wright, research pathologist of the Oregon Forest Research Center, and Dr. Walter B. Bollen, soil bacteriologist of Oregon State College.

NE Loggers Honor Two Educators

Two members of the faculty emeritus of the State University College of Forestry at Syracuse University have been honored by The Northeastern Loggers' Association at the sixth annual Northeastern Loggers' Conference held recently in Utica, N. Y.

They are Dean Emeritus Joseph S. Illick of 763 Ostrom Ave., Syracuse, and Professor Emeritus Nelson C. Brown of 122 Dorset Rd., Syracuse.

Both men received Distinguished Service Plaques "for distinguished service in forestry practice and education" during their long careers of service.

More than 300 foresters and loggers from 15 states and Canada were in attendance at the yearly conference.

Virginia Sawmill Exposition

The first annual Virginia Sawmill and Logging Exposition will be held at the Claudius Crozet Park in Crozet, near Charlottesville, on September 9-10. Twenty-five acres of space are available for exhibits, demonstrations, and contests. The exposition is sponsored jointly by the Lumber Manufacturers' Association of Virginia and the Virginia Polytechnic Institute Agricultural Extension Service.

All dealers and manufacturers of logging and milling machinery are invited to exhibit and demonstrate their equipment. Contests in wood chopping, crosscut and power sawing, and log rolling will be held on Saturday, September 10.

Information on the exposition may be obtained from Carl J. Holcomb, Extension Forester, Blacksburg, Va., or Bradford T. Dempsey, Box 8611, Richmond, Va.

Forestry Employment

S.A.F. members are privileged to insert one 60-word advertisement in this column without charge. Forest industries desiring to employ foresters may insert advertisements at the rate of $4 per column inch. Copy must be received by the end of this month for an advertisement to appear in the issue after next.

Obviously the Society cannot assume responsibility beyond making it possible for prospective employee and employer to enter into negotiations.

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Positions Wanted

Forester, B.S.F., Univ. of Georgia, 1957, major in Wildlife management. Age 24, married. Experience: two summers U. S. Forest Service and Fish & Wildlife service. Work included insect control, cruising, scaling, sawmill cut supervision, and marking. Presently serving as LTJG U. S. Naval Reserve. Release from service January 1961. Desire location southeastern area.
Box I. Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, B.S.F., 1958, University of Idaho. Age 27, 2 children. Experience 2½ years with Forest Service consisting of road location, timber inventory, appraisals, timber sale administration, bark beetle control, and other national forest administrative work. Desire position with private industry or consulting firm in Northwest or Alaska.
Box K. Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, B.S.F., Michigan State Univ. Age 28, single, veteran. Experience with state forestry division including cruising, timber sales, marking, scaling, planting, etc. Desire employment in private industry. Prefer Minnesota or Wisconsin.
Box L. Journal of Forestry, Mills Building, Washington 6, D. C.

B.S. (Gen. Forestry) La. Tech.; M.F. (Wood Technology) Duke Univ. Seven years experience with company producing sewing machine cabinets in research, production, and forestry. Desire similar position with company with a future. Area preference, South and East. Age 38, married, one child.
Box M. Journal of Forestry, Mills Building, Washington 6, D. C.

M.F. New York State College of Forestry, 1960 B.A. Park College, 1951. Age 31, married, family. Graduate: forestry economics and basic forestry. Undergraduate: social sciences. Seven years experience: camping and social service work. Summer experience: forest economics field research, mill operation, wood industry management. Desire forestry position with opportunity for accomplishment and advancement.
Box N. Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, B.S., B.S.F., University of Michigan, 1957. Age 26, single. Communication specialist U. S. Army July 57-59. Southern Forestry, CFI, 6 months. Western forestry, timber management and fire control, 1 year. Member American Society of Photogrammetry. Desires position with opportunity for some research and advancement.
Box O. Journal of Forestry, Mills Building, Washington 6, D. C.

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You can see what the going is like in the woods being cleared by H. H. Ray, Bay City, Texas. His D7 with a Rome K/G Blade averages an acre an hour in a stand that includes heavy live oaks. The K/G Blade slices through small trees at a single pass, downs larger trees in a few passes, then shears stumps at ground level. Foreman Walter Clements says: "Mr. Ray still has his first D6 which he bought nine years ago. We now have three D6s, this D7 and a D8; and we wouldn't have any other make but Caterpillar. It stands rougher treatment and gives longer life with less expense for operation. And our dealer service is excellent."

NOW A NEW D7 SERIES D TRACTOR

The new D7 Series D Tractor is packed with even more power and greater operating economy than previous models. A new Turbocharged D339 Engine develops 140 flywheel HP, 112 drawbar. Improved torque rise boosts its lugging ability 80%. The D7 also features a new dry-type air cleaner, new stronger final drives, new lifetime lubricated rollers and optional in-seat starting. With all these and other new advances, it retains such proved features as the exclusive oil clutch, which delivers up to 2,000 hours of service without adjustment. For site preparation and other hard work, no other machine of comparable size can match the new D7 Series D.

Your Caterpillar Dealer has a file of facts about Cat Diesel Tractors on all phases of site preparation. He'll be glad to show them to you. He'll be glad to demonstrate the D7, too, with any of several available tools. Name the date!

Caterpillar Tractor Co., General Offices, Peoria, Ill., U. S. A.

CAT DIESEL TRACTORS WITH ROME K/G BLADES CUT SITE PREPARATION COSTS 20% to 50%!

Compared with other methods, K/G Blades with all models of Cat Diesel Tractors have demonstrated 20% to 50% savings in clearing. Matching HP to the job application, the D4 is recommended for clearing brush up to 3" in diameter; the D6 for growth up to 8" in diameter; the D7 for growth up to 14" in diameter; and the D8 and D9 for use where terrain and timber require higher horsepower. The K/G Blade mounts on a "C" frame at a 28.5-degree angle with the tractor. A sharp armor-plate stinger projects 30" beyond the blade and easily slices through big trees . . . Paul Bunyan could never do it so easy.

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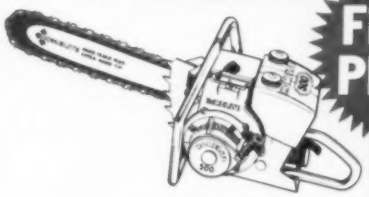

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